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INDUSTRIAL ARTS--AN ANALYSIS OF 39 STATE CURRICULUM GUIDES, 1953-1958.

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INSTRUCTIONAL TOPICS ARE REPORTED FOR SEVEN SUBJECT AREAS IN INDUSTRIAL ARTS FOR THE JUNIOR AND SENIOR HIGH SCHOOLS REPRESENTING 39 STATE CURRICULUM GUIDES AND 22 STATES. EMPHASIS IDENTIFIER IS THE FREQUENCY OF MENTION FOR EACH TOPIC BASED ON THE NUMBER OF GUIDES AND THE NUMBER OF STATES REPORTING EACH TOPIC. EXAMPLES SHOW THE MANNER IN WHICH THE INSTRUCTIONAL CONTENT IS PRESENTED IN THE STATE GUIDES. INCLUDED WITH EACH EXAMPLE IS THE STATE PATTERN OF ORGANIZATION FOR INDUSTRIAL ARTS. MAIN ELEMENTS IN THE CURRICULUM GUIDES ARE (1) FOREWORD, (2) PURPOSE AND PHILOSOPHY OF INDUSTRIAL ARTS, (3) GENERAL OBJECTIVES OF INDUSTRIAL ARTS, (4) INSTRUCTIONAL CONTENT, (5) ADMINISTRATIVE FACTORS, (6) LABORATORY (SHOP) PLANNING, (7) LIST OF TOOLS AND EQUIPMENT, (8) SAFETY, (9) EVALUATIONS, (10) METHODS OF TEACHING, (11) PUBLIC RELATIONS, AND (12) GENERAL BIBLIOGRAPHY. SUGGESTIONS CONTAIN A PROPOSAL TO IMPROVE THE INDUSTRIAL ARTS PROGRAM. A TEACHING PLAN IS PROVIDED. THIS DOCUMENT IS ALSO AVAILABLE FROM THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C. 20402, FOR $0.45. (TC)

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INDUSTRIAL ARTS

An Analysis of 39 State Curriculum Guides : 1953-1958

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Office of Education

Highlights

Instructional topics are reported for seven subject areas in industrial arts for the junior and senior high schools representing 39 State curriculum guides and 22 States. Emphasis identifier is the frequency of mention for each topic based on the number of guides and the number of States reporting each topic.

Examples show the manner in which the instructional content is presented in the State guides. Included with each example is the State pattern of organization for industrial arts.

Main elements in the curriculum guides are (1) foreword, (2) purpose and philosophy of industrial arts, (3) general objectives of industrial arts, (4) instructional content, (5) administrative factors, (6) laboratory (shop) planning, (7) list of tools and equipment, (8) safety, (9) evaluations, (10) methods of teaching, (11) public relations, and (12) general bibliography.

Suggestions contain a proposal to improve the industrial arts program. A teaching plan is provided.

OE-33019

INDUSTRIAL ARTS

An Analysis of 39 State Curriculum Guides, 1953–1958

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Contents

Page

Foreword IV

Introduction V
  Purpose of the study V
  Basic source material V

Chapter I. Instructional content analysis 1
  Delimitations 1
  Basic assumptions 2
  Procedures used in the content analysis 2
  Related research 2
  The rationale for the study 4
  Inferences derived from the analysis 32

Chapter II. Content presentation, patterns of organization, and main elements 34
  Part A. Representative examples of how the instructional content is presented in the curriculum guides with a summary of the State organizational pattern for industrial arts 34
  Part B. Main elements 59

Chapter III. Summary, conclusions, and suggestions 64

Bibliography 71

Foreword

ABOUT 100 years ago, steam and water power provided less than one-quarter of the energy needed for all production. Men and animals provided the rest. Today in the United States machines supply 98 percent of all power for industrial work. The technological change that has taken place in this time has been phenomenal and, undoubtedly, will be even more rapid in the future.

Industrial arts deals with the technology—its tools, materials, machines, industrial processes, and its related human problems. This study provides a detailed analysis of instructional content in State curriculum guides for selected subject areas of the industrial arts in the United States. The information derived from this study provides persons engaged in the improvement of instruction in the industrial arts at the State and local levels with basic data bearing on the nature, scope, and sequence of the industrial arts curriculum area in the public schools of the United States.

The Office of Education expresses its appreciation to Paul E. Harrison, Associate Professor, University of Maryland, who acted as consultant on the study. The Office is grateful also, to Kenneth E. Dawson, Executive Secretary, American Industrial Arts Association, Department of the National Education Association; and to Henry J. Rokusek, industrial arts teacher, Sligo Junior High School, Silver Spring, Md., for their suggestions and assistance; and to the Arlington County Schools for photographs depicting various activities of their industrial arts program.

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Introduction

THIS STUDY provides basic data related to the nature, scope, and sequence of industrial arts education in the public schools of the United States. It is basic to the curriculum area of industrial arts. Specifically, it will provide a bench mark for the identification of trends and provide primary source materials for personnel engaged in curriculum improvement at State and local levels. The study also will provide a base on which intelligent decisions can be made to determine the direction industrial arts should take in the years ahead.

The analysis deals with 39 published State curriculum guides about the industrial arts curriculum area in the public schools of the United States. The guides represent 22 different States.

Purpose of the Study

The primary purpose of this study, reported in Chapter I, is to analyze the instructional content reported in State curriculum guides in selected subject areas of industrial arts at the junior high school level (grades 7, 8, and 9) and the senior high school level (grades 10, 11, and 12).

The secondary purpose, reported in Chapter II, has two parts: Part A—to illustrate with representative examples the instructional content in the State curriculum guides for industrial arts. Included with each example is a summary of the State organizational pattern for industrial arts; Part B—to determine the main elements which make up the curriculum guides.

Chapter III contains the summary, conclusions, and suggestions for consideration.

Basic Source Material

The basic sources used in identifying the curriculum guides used in this study are the State curriculum guides kept on file at the U.S. Office of Education, and the Circular, *State Curriculum Guides for Industrial Arts.*[1] The guides used in this analysis were identified by State supervisors of industrial arts, consultants, or persons most responsible for the program of industrial arts in each State department of education.

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[1] U.S. Department of Health, Education, and Welfare; Office of Education. *State Curriculum Guides for Industrial Arts, 1941-58,* by Marshall L. Schmitt. Washington, D.C. An annotated bibliography, Circular No. 567. 33 p.

During the period 1953–58, 75 State curriculum guides were identified dealing with various aspects of the industrial arts. Of this number, 39 were selected for this study based on the need to accomplish the primary purpose.

Chapter I Instructional Content Analysis

IT HAS BEEN common practice for many years for various State departments of education to publish descriptive materials about various aspects in the curriculum area of industrial arts. Some of the descriptive materials relate to a single element, such as, planning school shops or laboratories; safety; philosophy; administrative factors; or instructional content. Other guides combine these elements in one publication.

These published materials seldom specify that the instructional content listed therein should be taught, but rather indicate that the materials should serve as a *guide* in teaching. The publications, or *curriculum guides* in industrial arts which contain instructional content, are the subjects of this study. This chapter deals with an analysis of the instructional content contained therein.

Delimitations

A number of delimitations were made upon the study, both initially and as it progressed.

All State curriculum guides in industrial arts were collected and reviewed for the study. This included a review of 75 guides for the years 1953–58 to determine their suitability for the analysis. Of the total number, 39 guides were adjudged to contain instructional content for industrial arts. The judgment was based on the criteria of meaning phrases or statements contained in the guides pertaining to instructional content suitable for teaching in the industrial arts. The instructional content represented by the various topics in the guides listed under "related information" or "manipulative activities" or other similar headings became important considerations in selecting or rejecting the guides.

The guides not used were eliminated for several reasons. Many of the guides did not contain instructional content. Several dealt with school-shop planning material as compared to instructional content. Three guides were safety manuals, but while they contained teachable material, it appeared that this would weight the data unduly in this area. Publications devoted to project suggestions were also excluded. Several guides written for the elementary school were not used unless they contained instructional content for grades 7 or 8. An annotated list of the State curriculum guides used in this study is given in the bibliography.

The analysis contains selected subject areas and not all those provided for in the States. The selected subject areas are: drawing and planning, woodworking, metalworking, electricity and radio (electronics), graphic arts, transportation and power mechanics, and plastics.

Only those curriculum guides written in the English language were used. Curriculum guides published by United States territories, except Hawaii (a territory at the time the study commenced), were excluded.

Basic Assumptions

The validity of this content analysis rests on certain basic assumptions. The more significant ones are:

1. That the documentary analysis, as a technique in descriptive research, is one way of identifying instructional content in industrial arts contained in the curriculum guides.
2. That the data derived from the curriculum guides can be a source of detached, impersonal, and unbiased information.
3. That it is possible for an individual experienced in public education, industrial arts education, and curriculum work to make an accurate analysis of the industrial arts curriculum guides.
4. That it is possible to establish certain criteria for the selection of curriculum guides containing instructional content.
5. That the curriculum guides used in this study were those published during the cited period.

Procedures Used in the Content Analysis

The content analysis involved the development of a study rationale; the review of related research; the collection of all State curriculum guides; the establishment of a general procedure for the study, including the limiting assumptions, and the various criteria; the collection of the data (analysis); examination of the data; development of logical inferences and summarizing statements.

Related Research

A review of related research revealed important studies dealing with the theory and method of content analysis, and specifically with analyses of industrial arts State curriculum guides. Each of the sources was reviewed for material pertinent to this study. The following summary of the more important related research is given:

ANDERSON, WILLIAM R. State Syllabi in Industrial Arts, unpublished Master's thesis, University of Minnesota, 1945. This thesis identifies 37 different subjects from 23 syllabi reviewed; it lists objectives and grade levels for each subject, teaching methods, planning, and equipment factors. It did not treat in detail teaching content for the subject matter areas.

Bruner, H. B.; Evans, H. M.; Hutchcroft, C. R.; Wieting, C. M.; *and* **Wood, H. B.** *What Our Schools Are Teaching.* New York, Bureau of Publications, Teachers College, Columbia University, 1941. This study is an analysis of the content of selected courses of study of which industrial arts was a major part. The detailed analysis of content covered 223 courses of study in industrial arts and vocational education that were available at Columbia University. Outlines were made of content in each course of study. These outlines formed the basis for identifying units and major topics. Each unit of instruction had a chart with the topics related to it listed. Each unit topic chart summarized the content according to an index of significance. For example, the index of significance for the engine lathe was 10/391/13. The meaning is: 10 courses of the 13 which were examined contained a unit or major topic on the "engine lathe" and a total of 391 items were devoted to a discussion of this particular unit or major topic. Correspondence with the individual responsible for the analysis in industrial arts reveals that the techniques used, although workable, had limitations.

Fears, Henry, *Jr.* A Survey of the Subjects Contained in State Industrial Arts Publications in the United States. A problem presented to the Industrial Education Department, Agricultural and Mechanical College of Texas. 1952. This publication presents data based on analyses and frequency of mention on objectives, subjects (36) and teaching methods. It recommends a new plan for developing an industrial arts curriculum guide but did not analyze content within subject matter areas.

Festinger, Leon *and* **Katz, Daniel.** *Research Methods in the Behavioral Sciences.* New York: The Dryden Press, 1953. 660 p. This publication contains a chapter on "Analysis of Qualitative Material." It discusses the major principles involved in converting symbolic "phenomena" into scientific data, some criteria useful in guiding decisions that must be made in constructing the system of categorization, and some practices found to be helpful in the actual process of categorizing symbolic material.

Mahoney, James H. State Instructional Materials in Industrial Arts: Their Status, Content, Preparation and Use. Unpublished Master's Thesis. Department of Industrial Education, University of Missouri, 1956. This thesis indicates some major topics included in State industrial arts publications, such as: background or introductory material, philosophy, the place of industrial arts in general education, industrial arts objectives, course objectives, terminology, grade placement and time allotment, topics for class discussion, suggested teaching plan, planning and equipping shops and laboratories, student participation in class management, organization and management (records and inventories, safety, and storage), book lists, and student achievement. Topics relating to the selection of content such as "manipulative activities" and "informational content" appeared in approximately 90 percent of the State publications that were examined.

Merritt, Eleanor *and* **Harap, Henry.** *Trends in the Production of Curriculum Guides.* Division of Surveys and Field Services, George Peabody College for Teachers, Nashville, Tenn. 1955 43 p. This survey covers various courses of study published in 1951 through 1953. It points out that in the last triennium 25 guides were produced in the field of industrial arts, which amounts to twice the output for the same period in an earlier study.

Three-fifths of these publications contained suggestions for adapting instructions to individual differences.

Murray, Edward J. A Content Analysis Method for Studying Psychotherapy, *Psychological Monographs, General and Applied.* No. 420, 1956. Vol. 70, No. 13. Edited by Herbert S. Conrad, Published by the American Psychological Association, Inc. This monograph discusses analysis of a patient and the methods of extracting meaning and emphasis from a transcript. Frequency count was used as an emphasis indentifier on statements, or meaning phrases, or a thought clause.

Schultz, William C. Theory and Methodology of Content Analysis, unpublished Ph. D. dissertation, University of California (Los Angeles), 1950. This summary of content analysis indicates how this method can be applied to a wide variety of situations. It emphasizes the importance of defining the categories of analysis precisely so that different analysts can apply these categories to the same body of content and secure the same results. The analysis must be systematic—that is, it must include only those analyses designed to secure data relevant to the problem.

The Rationale for the Study

The rationale for the study was to order the data (instructional content) from the curriculum guides into established categories and/or topics. The categories represent various similar groupings or classifications of topics in each subject area selected for the study. The categories were derived from the bulletin entitled, *A Guide to Improving Instruction in Industrial Arts.*[2] Approximately 100 industrial arts persons throughout the United States agreed to participate in the writing of this bulletin. This bulletin represented the thinking of many of the leaders in industrial arts education, and the present bulletin represents a result of the knowledge and effort that went into previous editions.

The categories were supplemented, reorganized, and deleted as the data were extracted from the guides. This process was developmental until all categories were considered suitable for the study.

The prime factor for selecting the subject areas to be analyzed was the frequency of their occurrence in the curriculum guides. An analysis revealed the frequency of each subject area and they were selected on that basis. The areas of drawing and planning, woodworking, metalworking, and electricity and radio (electronics) were consistently reported. The areas of graphic arts, transportation and power mechanics, and plastics were reported to a lesser degree. The seven selected subject areas were, thus, those most widely reported in the guides.

There were instances where curriculum guides were written on small units of instruction or instructional areas which were combined into subject areas. For example, units on sheet metal, and/or welding were included in the metalworking subject area, although there were one or more guides written specifically for these instructional units. Table I shows the subject areas reported by the 39 guides used in this study.

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[2] American Vocational Association. *A Guide to Improving Instruction in Industrial Arts.* 1010 Vermont Avenue, NW., Washington 5, D. C., The Association, 1953. 120 p.

The curriculum guides were separated into junior high school level (grades 7, 8, and 9) materials and those written for the senior high school level (grades 10, 11, and 12). The greater number of the publications were not so designated. The content of these guides was recorded at both the junior and senior high school levels. The decision, in this instance, was based in terms of evidence of intent as specified in the guides. Judgments were not made as to the appropriateness of content for the two levels.

Table 1.—Subject areas reported by 39 industrial arts curriculum guides, by grade level: 22 States, 1953–58

State	Number of guides	Drawing and planning		Woodworking		Metalworking		Electricity and radio (electronics)		Graphic arts		Transportation and power mechanics		Plastics	
		Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.	Jr.	Sr.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Arkansas	2	X	X	X	X	X	X	X	X	X	X	X	----	----	----
California	2	X	X	X	X	X	X	X	X	X	X	----	X	X	X
Georgia	1	X	X	X	X	X	X	X	X	----	----	----	----	----	----
Idaho	2	X	X	X	X	X	X	X	X	----	----	----	----	X	X
Illinois	1	X	----	X	----	X	----	----	----	X	----	----	----	X	----
Kentucky	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Maine	1	----	----	X	X	X	X	X	X	----	----	X	X	----	----
Minnesota	3	----	----	X	----	----	----	X	----	----	----	----	----	X	----
Missouri	1	X	----	X	----	X	----	X	----	----	----	----	----	X	----
Nebraska	1	X	X	X	X	X	X	X	X	----	----	----	----	X	X
Nevada	1	X	----	X	----	X	----	X	----	----	----	----	----	X	----
New Jersey	1	X	----	X	----	X	----	X	----	----	----	----	----	X	----
New York	3	----	----	X	X	----	----	X	X	X	X	----	----	----	----
North Dakota	1	X	X	X	X	X	X	X	X	----	----	X	X	X	X
Ohio	5	X	X	X	X	X	X	X	X	X	X	----	----	----	----
Oklahoma	1	X	X	----	----	----	----	----	----	----	----	----	----	----	----
Pennsylvania	6	X	X	X	X	X	X	X	X	----	----	X	X	X	X
Texas	1	X	X	X	X	X	X	X	X	X	X	----	----	X	X
Utah	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Virginia	2	----	----	X	X	----	----	X	X	----	----	----	----	----	----
Wyoming	1	X	----	X	----	X	X	X	X	----	----	----	----	X	X
Hawaii	1	X	X	X	X	X	X	X	X	----	----	----	----	----	----

The actual analysis involved three separate stages of work. First, each curriculum guide was given a code number for identification purposes. Tally sheets were prepared which contained the initial categories and topics obtained from the bulletin entitled, *A Guide to*

Improving Instruction in Industrial Arts, mentioned previously. The topic is the basic element used in this analysis and is a statement or meaning phrase, which was adjudged as instructional content for industrial arts. The categories are classifications or divisions of topics having related meanings. The establishment of additional or deletion of categories and/or topics was developmental as the analysis progressed. When a category was sufficiently specific, as in some cases; it, too, was treated as a topic.

Second, the topics of each curriculum guide for each subject area were ordered into the various categories and tallied. If the topic was noted more than once this was tallied also. The tally of each topic carried the identification number and page number of the curriculum guide. The ordering of the topics into the categories required the establishment of new categories and the deletion of some others. This was caused by additional topics as revealed in the analysis or the lack of them.

Third, all topics recorded were tabulated to show (1) the total number of times (frequency of mention) reported, (2) the number of guides they represented, and (3) the number of States they represented. The latter two tabulations tended to be the same because some States published several guides, but not more than one in each subject area. Tabulating the data this way allowed for the occurrence of any one topic in any one guide appearing several times. Thus, for example, a guide might include a large number of similar topics in a particular subject area which would produce a high frequency of mention, but yet not appear in many other State curriculum guides. Specifically, a topic which has a frequency of 105 derived from 6 curriculum guides, representing 6 States, would be less significant than one mentioned 40 times in 18 curriculum guides, representing 18 States. Table 2 shows the instructional topics reported from the 39 industrial arts States curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level, 1953–58.

The instructional topics in table 2 are arranged under the subject-matter areas of drawing and planning, woodworking, metalworking, electricity and radio (electronics), graphic arts, transportation and power mechanics, and plastics. The instructional topics as a rule, are grouped within categories, see column 1, table 2. Most categories contain a listing of several topics.

Columns 2 and 3 refer to the instructional topics tabulated for the junior high school, and columns 4 and 5 for the senior high school. Columns 2 and 4 report data on the *number of States* and the *number of guides* reporting the topics. Thus, a figure, for example 13, in either of these two columns means that 13 States reported this topic and it appeared in 13 different guides. Any variation of this is footnoted on the page where it occurs.

The instructional topics are arranged in table 2, within each category by the highest frequency of mention first to the lowest frequency for the total number of States and number of guides reporting the topic, (see column 2), under junior high school grades (7, 8, and 9)). Consequently, the listing of frequencies of mention under senior high school grades does not always follow this arrangement, (see column 4). The total frequency of mention, columns 3 and 5, indicates the total number of times the topic was reported in all 39 guides, the junior high school (grades 7, 8, and 9) or the senior high school (grades 10, 11, and 12), respectively.

Thus, in the subject area of drawing and planning, under the category of "Lines, 'Blueprints', and Symbols"; the topic of "Alphabet of lines" appeared for the junior high school (grades 7, 8, and 9) in 13 guides, representing 13 States, 57 times. And, for the senior high school (grades 10, 11, and 12) in 10 guides, representing 10 States, 39 times. The data can be interpreted this way throughout table 2. A dash in a column indicates the topic did not appear at that grade level.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58

A. DRAWING AND PLANNING

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
LINES, BLUEPRINTS, AND SYMBOLS				
Alphabet of lines	13	57	10	39
Reading blueprints	10	15	7	16
Reproducing blueprints	8	13	9	17
Symbols	7	12	5	7
Scale drawings	5	7	6	6
Conventional breaks	5	6	3	4
Types of paper	3	4	3	4
Sectional views	2	2	-----------	-----------
FREEHAND SKETCHING				
Techniques for sketching lines, arcs, circles, angles	12	60	10	44
Techniques for sketching isometric and nonisometric circles and arcs	6	7	3	4
Blackboard sketching	2	3	1	1
The shop sketch	1	1	3	3

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

A. DRAWING AND PLANNING—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
USE OF DRAWING INSTRUMENTS				
Use and care of drawing instruments	15	79	13	54
Pencil points, how to make and use them	13	36	8	26
Uses of T square, various triangles, and french curve	12	28	8	23
Triangular boxwood scale (architect's) and how to use its scales	9	15	7	12
PROJECT DRAWING				
Common fasteners used in metalwork	6	11	7	12
Drawing-room care	6	7	4	5
Electrical symbols	5	6	6	7
How to make layouts (stretchouts or patterns) for common sheetmetal projects	5	6	2	3
House wiring circuits	4	4	4	4
Special applications of multiview projection (scrambled views, full-scale views superimposed on other views, enlarged and section views as used by woodworkers)	3	5	3	4
Metal fasteners and methods of representation	3	5	2	4
Pipe, pipe threads and fittings	3	5	3	5
Schematic and pictorial representation of electrical circuits	3	3	2	4
Representation of cabinet details	2	3	2	2
Cams, gears and machine threads	2	2	2	2
Woodworker's method of dimensioning turned legs and irregularly curved surfaces and edges	2	2	2	2
Radio layout	1	1	3	3
Fillets and rounds	1	3	1	3
Welding representations	1	1	2	2
Wood fasteners and methods of representation	1	3	----------	----------
Specifications for cabinet lumber, board measure, and the cabinet maker's bill of material	1	1	1	1
Rough and finished castings (pattern drawings)	----------	----------	2	2
LETTERING AND DIMENSIONING				
Vertical and inclined gothic capitals	15	33	11	26
Vertical and inclined lower-case letters	13	26	9	24
Application of accepted dimensioning standards	13	34	11	25
Vertical and inclined numerals and fractions	12	20	8	15
Rules for dimensioning (American standards)	11	40	8	37
Arrowheads	10	13	8	12
Spacing between letters	8	10	5	7
Specifications and notes	7	11	6	8
Tolerances and allowances	----------	----------	1	1
APPLICATION OF RULES FOR SECTIONING				
Full sections, half sections	11	15	9	14
Methods of sectioning thin pieces	1	1	3	3
Cross hatching	1	1	1	1
Cutting plane	1	1	1	1
SHOP DRAWINGS (UNDERSTAND THE BASIC PROCESSES COVERED BY THEM)				
Drawings (working detail, assembly, machine, cabinet, furniture)	15	29	11	41
Special areas of interest (aircraft, boat lofting, foundry-wood patterns)	4	5	4	5
Sheetmetal layout and development	2	3	3	7
Value of patterns	1	2	----------	----------

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

A. DRAWING AND PLANNING—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
PICTORIAL DRAWING				
Isometric, oblique, exploded views, cabinet projection	14	63	10	41
Perspective drawings	5	10	4	4
Elevations	2	3	2	3
Value of pictorial drawings	1	1	-----	-----
ARCHITECTURAL BLUEPRINT READING AND HOME PLANNING				
Floor plans	10	16	7	14
Architectural symbols	4	5	3	3
Landscaping drafting	2	2	2	2
Structural drafting	1	2	3	4
Architectural sections	2	2	2	2
Practice in reading architectural plans	-----	-----	1	1
Builder's terms defined	-----	-----	1	1
MAKE GRAPHS, CHARTS, DIAGRAMS, MAPS	10	19	8	21
MAKE PENCIL AND INK TRACINGS AND MAKE PRINTS FROM THEM	10	19	8	13
OCCUPATIONS IN DRAFTING				
Opportunities	7	10	5	8
Kinds of manufacturing industries which employ draftsmen	5	12	3	5
Types of jobs	2	2	1	1
Number and kinds of workers	1	3	-----	-----
Wages and working conditions	1	1	1	1
LAYOUTS AND DEVELOPMENTS	12	33	8	31
PREPARATION FOR DRAWING	11	22	6	10
DESIGN	7	11	8	14
REDUCTION AND ENLARGEMENT	3	5	-----	-----
ORTHOGRAPHIC PROJECTION				
Erasing	6	10	5	8
Orthographic layout	15	78	11	54
Drawing to scale	12	14	8	9
Measurements	11	38	8	18
Arcs, circles, and angles	9	15	7	17
Hidden lines	9	11	6	7
Machine parts	3	5	7	14
REVOLUTIONS	1	1	1	1
AUXILIARY VIEWS	9	12	7	13
GEOMETRICS	14	104	10	84
INKING	6	11	5	10
SHADING AND COLORING	2	7	2	3
MODELS	-----	-----	1	3
VALUE OF DRAWINGS	1	3	-----	-----

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

B. WOODWORKING

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
1	2	3	4	5
DESIGNING				
Learn types of joints and their uses	15	135	10	53
Read and interpret a working drawing	10	13	8	11
Study methods of selecting and supplying acceptable designs	9	40	9	41
PLANNING				
Calculate cost of material for a project	16	25	11	22
Work out a plan of procedure	13	20	10	16
Make a working drawing	9	11	7	11
LAYOUT				
Draw stock and lay out designs on stock	17	152	14	143
Measurement	13	23	11	21
Make templates and transfer designs to stock	10	14	7	13
CHECKING WORKMANSHIP				
Lathe turning	13	163	13	180
Test for squareness with try square and framing square	11	12	6	7
Routing, mortising, etc	9	19	9	31
Test for a true surface with a straight edge and T-bevel	7	8	5	7
Jigs and fixtures	3	6	4	7
Check layout	2	3	2	3
USING AND ADJUSTING HAND TOOLS				
Intended purposes and uses of different types of planes (smooth, jack, jointer, etc.) and planing machines	[1] 22	175	16	166
Intended purposes and uses of different types of saws (cross-cut, rip, mitre, etc.)	21	281	15	285
Boring and drilling	19	88	14	73
Miscellaneous tools	17	93	14	79
Scraper cabinet, hand, etc	17	33	14	27
Gauging	14	27	10	15
Filing and files	14	16	10	11
Joint cutting on shaper (depending on age and experience of pupil)	8	61	14	118
Decorative edge cuts	1	1	1	1
FASTENING, ASSEMBLY, AND APPLICATION OF HARDWARE				
Types, uses and application of glue	20	45	15	42
Types, sizes, and uses of nails, brads, and screws	19	121	14	98
Assemble parts of projects with hand screw, bar, and C clamps	16	30	13	24
Other types of wood fasteners	15	33	11	19
Selecting, fitting, and application of cabinet hardware	13	97	11	87
Final assembly of project	1	9	1	9
PREPARING FOR FINISH AND FINISHING				
Preparation and application of different types of finishes	20	109	15	151
Preparation of wood surfaces for different types of finishes	18	66	12	50
Abrasives	16	67	12	51

[1] 23 guides reported topic.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

B. WOODWORKING—Continued

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
1	2	3	4	5
CARE AND USE OF FINISHING TOOLS AND EQUIPMENT				
Clean and store brushes	15	34	10	29
Clean and assemble spray gun	3	3	4	5
Storage of finishing materials	----------	----------	1	1
CARE AND MAINTENANCE OF TOOLS				
Sharpen different types of cutting edges	19	56	11	48
Care and fitting tools and machines	13	144	11	157
Set and sharpen different types of saws	3	5	3	5
Prepare tools for storage	3	3	2	2
SURFACE DECORATION				
Carving	6	8	5	5
Inlay	3	4	4	5
Marquetry	1	1	1	1
UPHOLSTERY				
A knowledge of the different types of upholstering materials and their application	8	33	6	34
A knowledge of the different types of upholstering construction and their application	4	11	4	11
OCCUPATIONAL INFORMATION				
Divisions of labor (skilled or unskilled) and types of machines used in each manufacturing concern	5	5	5	5
Name and location of manufacturing concerns and products produced by each	3	4	3	4
CONSUMER KNOWLEDGE				
Materials used in wood construction and the qualities of each	1	2	1	2
Construction used in furniture manufacturing	1	1	1	1
PLANNED INDUSTRIAL TOURS—LOCAL RESOURCES				
Visit industrial plants	1	10	1	10
HEALTH AND SAFETY				
Safety rules for each machine and for each shop	17	189	14	191
UNDERSTANDING MASS PRODUCTION				
Set-up production job	1	1	----------	----------
HABITAT AND USES OF NATIVE WOODS				
Where each type of wood is grown and what each type of wood is suited for in construction of furniture	14	23	10	17
Tree structure and identification	12	30	7	20
Moisture constant areas throughout the United States and the effect of moisture on woods	8	10	9	12

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

B. WOODWORKING—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
PURCHASING AND MEASURING OF LUMBER				
Board foot, square foot, and linear foot measurements in lumber	13	19	9	14
Terms "S4S"; "S2S"; "Lumber in the rough"; and other symbols used in purchasing yard, mill, and cabinet lumber	9	21	5	14
How lumber is purchased	3	3	2	2
PRODUCTION OF LUMBER				
Cutting and milling of lumber	12	13	10	11
How plywood is made and how veneer is cut	11	15	9	13
Lumber seasoning	10	11	7	8
USES OF FOREST PRODUCTS				
How to conserve forests and forest products	7	7	5	5
By-products from trees such as insulation, rayon, sugar, paper, and plastics	3	3	3	3
What the manufacturer produces from the forest products	2	2	1	1
PERIOD DESIGN IN FURNITURE				
Different designs of distinctive furniture and their periods	6	19	6	19
Outstanding characteristics of each type of period furniture	1	1	-----	-----
GLUES AND THEIR USES				
Types of wood glues and their applications	8	24	6	19
COMPOSITION AND TYPES OF FINISHES				
Different types of wood finishes and their applications	13	70	8	59
ROLE OF WOODWORKING IN THE INDUSTRIAL ENVIRONMENT				
Kinds of jobs and requirement	8	19	6	17
Home workshops	5	6	3	4
Waste versus conservation	5	6	3	4
Pay and working conditions	2	2	2	2
Manufacture of lumber	2	2	1	1
Fabrication of wooden objects	1	1	1	1
Economic return	1	1	1	1
Social effect	1	1	1	1

C. METALWORKING

DESIGNING A PROJECT				
Make and read a working drawing	11	16	10	18
Study principles and elements of design and select a project	6	12	6	16
Create a design	6	12	4	7
Make a dimensional sketch	5	6	4	5
Learn about working qualities of metal that affect design	2	2	4	6
Apply drafting fundamentals and principles	-----	-----	1	35
Learn about types of assembly that affect design	-----	-----	1	2
Use proper abbreviations and symbols on drawings	-----	-----	1	1

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

C. METALWORKING—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
PLANNING AND PRODUCTION CONTROL				
Make a plan of procedure	14	38	12	38
Make a bill of materials	6	11	8	19
Make an analysis of cost	2	7	3	4
Make a time estimate for job			2	3
MEASURING				
Measure and divide spaces with a rule	9	20	9	23
Measure with micrometer	6	11	7	13
Use of steel square, combination	6	10	6	9
Measure with outside calipers	5	11	6	13
Measure with inside calipers	5	9	6	11
Locate centers with hermaphrodite calipers	4	6	6	8
Transfer dimensions with dividers	4	6	4	6
Gauge parts with gauges and indicators	3	5	5	10
Measure and test angles with a sign bar	2	2	2	3
Measure angles with protractor	1	1	3	4
Measure with a vernier			2	2
LAYOUT				
Make a simple layout on metal	11	41	10	38
Make a layout on paper and transfer it to metal	10	17	10	16
Layout by parallel line development	8	14	11	19
Layout by radial development	8	14	11	19
Develop a pattern	6	11	6	25
Layout a scroll or curve	5	7	4	5
Scribe arc with divider	4	10	4	9
Layout with prick or center punch	5	8	4	7
Make a template	4	4	6	8
Layout by triangulation	4	4	6	6
Apply layout dye or coating	1	2	1	2
Select design for decorating	1	1	1	1
Layout with trammel points	1	1	1	1
CUTTING				
With hand tools, including hack saw, cold chisel, jeweler's saw, and tin snips	17	109	13	105
With lathe, shaper, milling machine, broach, planer	9	205	9	245
With squaring, ring, circle, and bench shear	9	17	11	28
With power hack saw, band saw, and jig saw	6	11	9	21
With acetylene torch	1	3	1	3
DRILLING, BORING, REAMING, AND PUNCHING HOLES				
Drill holes with hand drill	14	34	10	26
Drill holes with drill press, lathe, milling machine	14	63	12	72
Punch holes with solid or hollow punch, by hand	13	37	13	37
Bore holes with drill press, lathe, milling machine	6	18	8	22
Ream holes with drill press, lathe, milling machine	4	7	7	11
Ream with hand reamer	4	6	4	5
Spot face	3	3	4	4
Punch holes with forging tools in hot metal	2	7	2	7
Punch holes with machine punch	1	2	2	3
BENDING AND TWISTING METAL				
By hand when cold	15	39	10	35
With machines	6	9	5	9
By hand when heated	5	12	4	15
Form with bending jig	4	4	5	6

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

C. METALWORKING—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
SHAPING AND FORMING METAL				
Form to shape by hand when cold or hot	14	88	11	85
Use sheet metal machines, such as forming rolls, bar folder	10	79	11	106
Fold hems or seams with hand seamer	7	8	6	6
Form to shape by hand when heated	6	24	5	25
Groove with hand groover	6	8	7	9
By pouring into molds	6	9	5	7
By spinning	3	11	5	14
With machines, such as lathe, shaper, milling machine	1	22	2	26
HEAT-TREATING METAL				
Annealing	13	29	10	22
Hardening	10	12	9	11
Tempering	8	10	9	11
Case hardening	4	5	6	7
Identify metal by spark test	3	6	2	5
Normalizing	2	2	3	3
Use hardness tester	1	1	1	1
SMOOTHING METAL				
With files, scrapers, burnishers	16	66	12	52
With grinding wheels	7	54	7	46
With abrasive materials	4	8	5	8
CUTTING THREADS				
With taps and dies by hand	8	22	7	21
With taps and dies on drill press, milling machine, lathe	5	16	6	18
Remove broken tap or drill	3	5	3	5
Cut external or internal threads on lathe	2	3	3	6
ASSEMBLING METAL PARTS				
By soft soldering	16	59	13	53
With rivets	16	40	12	34
With seams	10	26	11	30
With metal screws	7	8	7	9
By brazing	5	17	9	26
With bolts and machine screws	5	9	4	5
With joints	5	7	7	9
By acetyline welding or cutting	4	63	8	85
By arc welding	4	43	7	63
Test welds	4	6	5	13
By hard soldering	4	6	7	11
By spot welding	2	3	3	7
Propane gas	1	1	1	1
Assemble fittings	1	1	1	1
Calk a joint	1	1	1	1
DECORATING THE SURFACE OF METAL				
By peening and planishing	9	20	9	19
By chasing, doming, fluting	7	17	6	17
By etching or engraving	6	16	7	16
Design stamping	6	9	6	7
Knurling	5	8	7	10
By overlay	3	5	3	5
Spot finishing	1	1	2	3
By repousse	1	1	1	1
Set a stone	1	1	1	1
Paneling			2	2

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

C. METALWORKING—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
FINISHING THE SURFACE OF METAL				
By polishing, buffing	15	50	12	40
By painting with paint, enamel, varnish, lacquer, wax	14	58	10	43
By coloring with chemicals	10	16	8	15
By coloring with heat	8	11	7	12
Clean metal with acid	5	9	5	11
By spraying	4	6	3	5
Clean a solder surface	4	4	2	2
Lapping or honing	3	4	3	4
By plating	2	4	3	6
Scratch finish with wire wheel	2	2	3	4
By metalizing	2	2	2	2
By sand blasting	----------	----------	1	2
Tumbling	----------	----------	1	1
CLEANING AND CARING FOR TOOLS AND MACHINES				
Clean and tin soldering copper	11	15	10	14
Sharpen hand tools, such as punches, cold chisels, drills, shears	7	29	8	24
Regulate and adjust machines	6	54	9	59
Clean and lubricate machines	6	27	6	29
Sharpen cutting tools for machines, such as tools bits for lathe, shaper, and milling cutters	5	35	8	47
Regulate and adjust hand tools and equipment	4	14	5	15
Grind centers	4	4	5	5
Clean and oil hand tools	4	4	4	4
Dress and mount grinding wheel	3	8	5	9
Repair a mold	3	4	4	6
Temper sand	3	5	5	8
Repair and replace belts	2	4	2	5
Repair wood patterns	----------	----------	1	1
SOURCES OF RAW MATERIALS				
Where raw materials come from	10	14	7	11
How they are mined and extracted	6	7	6	8
How they are shipped to processing plants	2	2	2	2
Geographical distributors	1	1	2	2
Sources of equipment	----------	----------	1	1
REFINING OF METALS				
How other metals are refined and produced	11	18	9	13
How steel is made	10	21	8	18
How copper and its alloys are refined and manufactured	7	21	8	19
How aluminum is refined and produced	7	11	6	7
How tin and tinplate are manufactured	4	8	4	7
How wire is made	3	6	2	3
Manufacture of pipe	1	1	1	1
CHARACTERISTICS OF METALS				
Comparison of color, cost, working qualities, characteristics, identification	13	66	11	62
Properties of metals	13	39	11	39
Common kinds and shapes	13	39	12	38

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

C. METALWORKING—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
CONSUMER USES OF METALS				
Where metal is used in home construction, home utensils, appliances, commerical construction, transportation (automobiles, airplanes, ships, trains) jewelry and silverware, scrap	13	46	9	27
How metal is purchased-cost (sheets, angles, shapes)	5	13	4	7
How items of metal, such as pipe, rivets, screws, wire are purchased	4	6	4	6
OCCUPATIONAL INFORMATION				
Opportunities	12	60	8	39
Wages and working conditions	8	47	5	18
Kinds of manufacturing concerns	9	46	5	16
Fields of metalworking	7	44	6	37
Number and kinds of workers in each field	7	43	5	34
Kinds of manufacturing concerns	5	12	4	11
Requirements	1	1	1	1
Trade publications	------	------	1	2
Apprenticeship system	------	------	1	1
Purchasing and caring for tools, materials, and machines for home metal workshops, including home repair and hobby activities	4	21	3	9
HISTORY AND DEVELOPMENT				
Metalworking processes	6	16	5	10
Tool development	5	5	2	3
Metals	2	4	2	3
Machine tool development	2	3	7	53
INDUSTRIAL TECHNIQUES AND PROCEDURES				
Mass production methods	4	9	5	9
Uses of jigs and fixtures	4	5	4	7
Industrial design and drafting procedures	3	8	4	8
Machine tool manufacture	3	3	4	5
New machines and processes	3	10	2	7
PRINCIPLES UNDERLYING METALWORKING PROCESSES				
Principles and characteristics of heat treatment	9	34	[2] 7	51
Speeds and feeds	6	28	7	40
Related advanced mathematics	3	6	3	7
Theory of metal cutting	3	4	2	3
Principles of power transmission	2	9	2	14
TYPES AND USES OF HAND TOOLS				
Cutting tools	11	55	------	------
Layout and measuring tools	8	16	5	12
Assembly tools	8	11	5	10
Forming tools	6	13	5	10
Striking tools	5	8	11	50
Holding devices	4	10	5	6
TYPES AND USES OF MACHINE TOOLS	5	44	7	75

[2] 6 States reported topic.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

C. METAL WORKING—Continued

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
1	2	3	4	5
Materials and Supplies				
Types of fasteners and their application	16	42	[3] 12	55
Types of solder	15	23	[4] 11	18
Types of fixes and dipping solutions	14	28	[5] 12	24
Finishes	9	50	8	62
Types of abrasive materials and application	6	12	5	31
Types and uses of coolants and lubricants	6	11	7	21
Use of salvage materials	2	2	2	2
Welding				
Welding practices and procedures	4	74	5	120
Types of welding rod and electrodes	3	6	5	9
Types of welders	2	2	4	6
Types of torches and their application	1	4	2	4
Foundry				
Foundry practices and procedures	5	59	6	68
Types and sources of molding sand	5	7	5	6
Casting metals and alloys	6	8	5	6
Types of patterns	5	5	4	5
Principles of patternmaking	1	3	----------	----------
Sheet Metal				
Types of sheet metal seams and assembly procedures	2	15	1	14
Uses of templates and patterns	2	2	4	6
Methods of forming irregular shapes	2	2	2	2
Soldering procedures	----------	----------	1	3
Plumbing Procedures and Practices	1	13	1	13
Forging Practices and Procedures	3	10	1	7
Machine Tool Operations				
Kinds and uses of threads and gears and how they are machined	8	43	9	56
Methods of cutting tapers	4	10	6	25
Grinding, sharpening and polishing procedures	4	4	----------	----------
Knurling practices and procedures	1	3	1	3
Uses of the index head	1	1	----------	----------
Related Drafting Procedures				
Types of sheet metal developments	3	5	4	7
Principles and fundamentals of drafting	3	3	4	105
Safety				
Safety rules and practices, health precautions, proper dress and first aid	8	64	9	73
How to use machines safely and properly	5	50	8	85
How to use tools and equipment safely and properly	4	47	6	86
Principal Parts of Tools, Machines and Equipment—Identification and Use	7	36	9	48

[3] 11 States reported topic.
[4] 10 States reported topic.
[5] 11 States reported topic.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

C. METALWORKING—Continued

Instructional topic	Grade level: 7-8-9 — Number of States and number of guides reporting topic	Grade level: 7-8-9 — Number of times reported	Grade level: 10-11-12 — Number of States and number of guides reporting topic	Grade level: 10-11-12 — Number of times reported
1	2	3	4	5
TOOL MAINTENANCE				
How to keep tools and equipment in good repair and working order	7	9	8	38
How to keep the machines in good repair and working order	4	15	7	35

D. ELECTRICITY AND RADIO (ELECTRONICS)

Instructional topic	7-8-9 — Number of States and number of guides reporting topic	7-8-9 — Number of times reported	10-11-12 — Number of States and number of guides reporting topic	10-11-12 — Number of times reported
EXPERIMENTATION AND DEVELOPMENT				
Sketching and defining ideas	3	6	1	4
Formulating the idea based on need	1	5	1	5
Experimenting and tentative designing	1	1	--------	--------
PLANNING				
Schematics	13	34	14	112
Calculation of electrical components (Ohm's and other basic laws)	12	31	13	38
Application of electrical symbols and codes	12	18	13	39
Plan of procedure	8	12	9	19
Bill of materials and cost	2	2	2	2
Opening a circuit and tagging	1	1	2	2
Handling high voltages	1	1	2	2
Discharging condensers	1	1	2	2
Dressing electrical burns	--------	--------	2	2
USE OF TOOLS AND EQUIPMENT				
Special electrical tools (wire strippers, gauges, wire, hickies, blow torches, pliers of all types, chassis punch, alignment tools)	11	69	9	55
Common metal and woodwork tools	2	2	4	19
Common metal and woodwork machines	--------	--------	2	2
INSULATING TECHNIQUES				
Removing insulation	10	13	8	12
Cutting and applying paper, asbestos, sealing compounds and other materials as insulation	4	5	4	7
Dipping coils in varnishes	2	1	1	1
Insulating terminals	1	1	--------	--------
INDUCTION AND CAPACITANCE				
Induction and reactance	6	16	4	14
Electromagnets	6	8	6	12
Transformers	4	7	6	12
Solenoids	4	5	5	9
Capacitance and reactance	3	5	3	5
WIRING TECHNIQUES				
Splicing	13	52	12	52
Nonpermanent connections, single and multiple (clips, clamps, edge-on, staples, binding posts, dot fasteners, patented connectors)	12	24	10	25
Underwriters knot	11	13	[6] 10	14

[6] 9 States reported topic.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

D. ELECTRICITY AND RADIO (ELECTRONICS)—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
WIRING TECHNIQUES—Continued				
Series and parallel circuits	11	53	10	63
Soldering electrical connections	9	17	8	13
Permanent connections	4	21	5	34
General wiring techniques	4	14	8	43
Fastening wires to wall (insulated nails and staples)	2	3	3	4
Selecting various types of wires	1	3	1	3
Lacing wires together for panels	1	1	1	1
Extension cords, lights, and appliances	1	8	-------	-------
Shielding (electrical)	-------	-------	1	1
CIRCUIT ANALYSIS				
Measurement of voltage, current power, etc.	15	94	14	101
Signal systems	13	98	11	82
Continuity	5	8	4	6
Diagnose troubles	2	4	1	2
Testing tubes	1	1	3	3
Using signal generator	-------	-------	1	1
REPAIR AND UPKEEP OF ELECTRICAL EQUIPMENT				
Appliance maintenance	12	69	14	105
Switches	11	35	12	46
Convenience outlets	8	18	7	15
Reassembling electrical machines (examination and replacement of worn parts)	4	11	2	32
Automotive circuits	3	13	5	58
D.C. motors (series shunt)	2	34	2	46
A.C.-D.C. motors	2	34	4	43
Application of circuit analysis to electrical components	2	17	-------	-------
Transformers	2	8	1	8
Generators	2	3	4	6
Disassembling electrical machines	2	3	2	5
Heating units	2	2	2	6
Synchronous motors	1	28	2	29
Series wound	1	27	3	29
Squirrel cage induction motor	1	27	2	29
Capacitor start induction run	1	27	3	30
Split phase start induction run	1	27	3	32
Lighting (incandescent, fluorescent, heat-sun lamps)	1	10	1	10
Batteries (charge and discharge)	-------	-------	1	2
FABRICATION OF AN ELECTRICAL DEVICE SHOWING APPLICATION OF ELECTRICAL ENERGY				
Heating effect (high resistance wire, high frequency)	11	45	14	36
Power (electric motors, transformers) power sources	9	32	9	53
Communications (radio receiver, transmitter, telephone, radar and sonar, telegraph, television)	8	36	8	91
Magnetic	8	33	5	22
Lighting effect (incandescent lamps, fluorescent lights)	8	26	7	25
Chemical processes (primary cell, secondary cell, electroplating)	4	12	5	7
Photo-electric	2	5	3	7
Test equipment	1	1	3	5

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

D. ELECTRICITY AND RADIO (ELECTRONICS)—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
Power Installations				
Residential (two-wire, three-wire, service entrances)	3	3	4	5
Codes (national, local)	2	2	[7] 6	10
Wiring devices (switches, boxes, plugs, outlets, fuses-renewable and nonrenewable, nipples, lock nuts, bushings, bonding and jumpers, condulets)	1	13	1	13
Kinds of installations (rigid conduit, armored cable, flexible metallic tubing, methods of grounding, methods of metering, wire mold raceways)	2	2	------	------
Experimental and Operational Activities				
Amplifiers	------	------	4	6
Detectors	------	------	3	5
Transmitting	------	------	2	2
Power supplies	------	------	2	2
Occupational Information				
Opportunities for employment in electrical industries	9	31	11	50
Improvement of standard of living through electrical power	2	7	1	5
Terminology	2	6	4	8
Educational requirements	2	4	2	7
Mass production techniques and their effects on workers	2	2	2	9
Importance of industry	2	2	1	1
Recreational facilities for workers	2	2	------	------
Pay scales	1	3	1	1
Consumer Knowledge				
Selection, use and care of electrical appliances	4	13	7	53
Interpretation of name plate information	4	6	7	9
Evaluation of design of electrical goods	4	5	5	21
Cost of electrical power	3	6	3	6
Home lighting requirements	2	7	1	2
Health and Safety				
Fuses and circuit breakers	11	46	16	56
Safe practices in the home	10	50	11	60
Underwriter's codes	6	17	6	15
Industrial safety	5	7	5	10
Treatment of shock	6	7	4	5
Circuit testing	3	4	2	2
Making circuit connections	3	5	2	2
Handling live wire properly	2	2	2	2
Handling common electrical emergencies	1	1	3	3
Overloading circuits	2	4	3	5
Fire safety	2	2	3	3
Grounding	1	1	2	2
Knowledge of first aid	------	------	2	2
Understanding Industry				
Generation (hydro-electric, steam-electric, water way improvements, atomic energy)	13	21	14	31
Transmission of electrical power (towers, poles, transformers, state distribution system, national distribution system, voltages)	6	34	8	38

[7] 5 States reporting topic.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953-58—Continued

D. ELECTRICITY AND RADIO (ELECTRONICS)—Continued

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
1	2	3	4	5
UNDERSTANDING INDUSTRY—Continued				
History	5	11	8	22
Consumption of electrical power (urban-rural, industrial)	4	7	4	8
Manufacturing plants (equipment and tools, types of laboring force)	2	5	5	8
Cultural utilization of radio, electricity	1	1	3	7
Developments in electricity	1	1	....	....
NATURE OF ELECTRICAL PHENOMENA (GENERAL)				
Battery types (wet, dry)	12	41	8	20
A.C. and D.C	11	26	[1] 16	25
General characteristics	11	20	10	14
Storage batteries	9	29	9	29
Transfer of electrons	9	13	13	20
Insulating factors	8	36	8	36
Field intensity	8	25	[2] 13	34
Carrying capacity, circular mill	8	15	10	22
Resistance	7	18	8	18
Magnetic	6	36	7	33
Electro-magnetic	6	22	3	19
Static electricity	6	23	5	14
Polarity (magnetism)	6	13	8	16
Transformers	6	10	8	18
Heat	6	9	9	22
Measurement	5	10	8	22
Molecular theory	4	8	5	7
Atomic structure	4	6	1	1
Induction	4	5	3	5
Cycle	4	4	6	7
Power	3	4	5	7
Cells	2	5	3	3
Polarity (current and voltage)	2	3	2	2
Fixed variable	2	2	4	4
Coils	2	2	3	4
Chemical	1	11	1	1
Electrolytic	1	1	4	4
Phase	1	1	5	6
Piezo-electric	....	....	1	1
Frequency	....	....	4	12
NATURE OF ELECTRICAL PHENOMENA (ELECTRONIC)				
Circuits (radio frequency, oscillator, audio frequency, FM and AM, TV)	6	28	8	73
Receivers (crystal, regenerative, superheterodyne)	3	8	5	6
Detection (modulation, demodulation, types)	3	5	4	6
Types of transmitters	3	3	7	7
Federal communications regulations	2	6	2	6
Wave preparation (ground, sky)	2	6	7	12
Thermionic emission (diodes, triodes, and multigrid tubes)	2	2	8	20
Reproducers and microphones	2	3	6	22
Antennas	1	1	4	11
Wave length	1	1	4	4
Characteristics of ionosphere	1	1	3	3
Semiconductors	....	....	1	2

[1] 15 States reported topic.

[2] 12 States reported topic.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

D. ELECTRICITY AND RADIO (ELECTRONICS)—Continued

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
1	2	3	4	5
TYPES OF CIRCUITS				
Parallel	9	16	10	17
Series	9	15	[19] 10	16
Control	4	8	6	11
Series-parallel	3	4	2	2
Vacuum tube	2	2	5	8
Rectifiers and power supplies	1	1	2	4
Resistance	1	1	2	2
Photo electric	----	----	1	3
Tuned	----	----	1	1
MEASURING DEVICES (THEORY)				
Voltmeter	10	18	11	22
Kilowatt hour meter	9	17	8	18
Ammeter	9	14	11	20
Wattmeter	4	11	6	13
Ohmmeter	4	5	5	9
Continuity devices	2	6	1	1
Tube tester	2	3	2	2
Photo-electric meter	2	2	3	3
Hydrometer	2	2	2	2
Signal generator	----	----	2	3
Oscilloscope	----	----	2	2
Multimeter	----	----	1	1
MANUFACTURE AND PROCUREMENT OF MATERIALS				
Wire	4	6	4	8
Tapes (friction, rubber, plastic, cotton, mica, asbestos, oil, sealing compound)	3	12	----	----
Solder	2	3	1	1
Nichrome	2	2	3	6
Aluminum	2	2	2	3
Cables	2	2	3	3
Coaxial	1	1	2	2
Hardware	1	1	1	1
Special materials	----	----	3	7
Components	----	----	2	4
Copper	----	----	1	1
INDUSTRIAL AND MEDICAL APPLICATION OF BASIC ELECTRICAL PRINCIPLES				
Control circuits		8	5	14
Induction heating	1	1	1	1
General processing	----	----	1	1
MATHEMATICS				
Arithmetic	2	2	2	17
Electronic formulas	1	1	1	17
Advanced mathematics	----	----	1	2
SCIENTIFIC UNDERSTANDINGS				
Chemistry	2	10	2	13
Physics	1	10	1	10

[19] 9 States reported topic.

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

D. ELECTRICITY AND RADIO (ELECTRONICS)—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
ROTATING EQUIPMENT				
Motors	7	16	11	78
Generators	4	5	8	31
RECREATIONAL ASPECTS				
Amateur radio	2	2	3	4
Hobbies	1	2	3	5

E. GRAPHIC ARTS

Instructional topic	7-8-9: Number of States and number of guides reporting topic	7-8-9: Number of times reported	10-11-12: Number of States and number of guides reporting topic	10-11-12: Number of times reported
RELIEF PRINTING				65
Printing (letterpress)	8	47	7	59
Principles of job layout and design	8	25	6	41
Hand composing	7	82	6	116
Imposing	7	26	7	50
Plate making (line cuts, halftones, stereotypes, electros, linoleum and wood blocks, rubber stamps, plastic plates)	6	27	7	57
Proofing	6	24	5	20
Making the layout or design	6	15	5	15
History of printing	6	15	6	36
Inks and ink manufacture	6	8	5	14
The significance of relief printing as a means of communication in the development of our civilization	6	7	5	6
Type, designing and the manufacture of type	6	6	6	10
Machines of the printing industry	5	12	5	15
Careers in printing	5	7	5	12
Techniques of composition (by hand or machine)	5	29	4	53
Kinds and uses of various spacing materials	5	21	4	22
Kinds and styles of type identification	5	19	4	19
Power press procedures and types	5	19	6	28
Taking and reading proof	5	17	5	17
Measuring type matter	5	14	4	17
Types of relief cuts	5	8	4	12
Operating various types of relief presses	5	5	3	3
Clean and care for equipment	4	14	6	46
Plan a procedure job ticket	4	8	4	8
Use of blockprinting today	4	6	4	5
Type case layouts	4	15	4	14
Type and appreciation of blockprinting methods	4	6	4	6
Safety in the printing shop	3	9	5	16
The interdependence of graphic arts industries	3	3	2	2
Manufacture of linoleum	3	3	2	2
Techniques of imposition	3	21	3	41
Types of proof presses and their application	3	4	2	3
Handling type	3	3	3	4
Avocational possibilities	2	3	3	4
How our daily newspapers, magazines, textbooks are produced	2	3	1	1
Makingready on the press and getting a good impression	2	13	3	37
Four-color process printing	2	2	2	2
Use of dictionary and other references	2	2	2	2
Technical terms of the printer	2	2	2	2
Typecasting	1	3	2	19
English and grammar	1	1	3	14
Use of rubber plates and stamps in printing	1	2	1	5
Science, technology, and new frontiers in printing	1	1	1	2

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

E. GRAPHIC ARTS—Continued

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
1	2	3	4	5
RELIEF PRINTING—Continued				
History of type case layouts	1	1	----------	----------
Factors to consider when buying printed materials	1	1	----------	----------
Care for equipment	1	4	1	4
Printing halftones and other relief cuts	1	2	3	10
Human relationships and labor management problems	----------	----------	2	7
Sources of raw materials in printing	----------	----------	1	6
Estimating costs	----------	----------	2	17
STENCIL PRINTING (SILK SCREEN, MIMEOGRAPHING, XEROGRAPHY)				
Preparing and applying stencil (mimeograph, silk screen, paper photographic stencils, painting, duplicating)	8	51	7	51
Prepare and apply printing, painting, duplicating, spraying	6	21	4	13
Care for tools and equipment	5	10	5	10
Making the design or layout	4	5	3	4
Various uses of silk screen printing, such as, ads, posters, and names on industrial products	4	12	3	7
Principles of design for silk screen work	2	18	1	7
Advantages and uses of mimeograph or duplicating processes	2	2	2	4
Methods of making designs	2	4	1	2
Adaptability of silk screen process	2	3	2	3
Making a silk screen frame and placing silk in frame	1	2	2	4
Flocking (silk screen)	1	1	1	1
Silk screen printing as a hobby in rehabilitation	1	4	----------	----------
Methods of block out	1	2	1	2
Opportunity in silk screen in industry	1	1	3	3
Suitable kinds of silk and materials	1	10	2	12
Appropriate techniques in applying paint with the silk screen squeegee	1	9	2	10
Suitable kinds of paints, lacquers, thinners	1	4	2	6
Principles of silk screen printing	1	4	2	6
Multi-color printing	1	2	2	6
Types of stencils used on silk screen printing	----------	----------	1	2
Flocking and beading and their uses	----------	----------	1	2
Flocking techniques	----------	----------	1	2
Construction of frames	----------	----------	1	2
Operating a stencil duplicating machine	----------	----------	1	1
BOOKBINDING				
Jog and fold paper	6	12	4	10
Sewing the book	5	8	3	4
Preparing the book and/or materials	4	16	3	5
Padding procedures	3	7	2	7
Repair a book	3	5	1	1
Planning the project or problem	2	2	1	1
Uses and significance of books and bookbinding	2	3	1	1
Work of the librarian	2	3	----------	----------
Materials selected in terms of suitability to use	2	2	1	1
History of bookbinding	2	2	----------	----------
Proper finding techniques for strength	2	4	----------	----------
Types of binding	2	2	1	3
Care and use of books	2	2	1	1
Essential tools and equipment	[illegible]	1	1	1
Career opportunities	1	1	1	1
Significance of paper to the graphic arts	1	1	----------	----------
Procedures for bookbinding	1	1	----------	----------
Technical terms used	1	1	----------	----------
How books are sold	1	1	----------	----------

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

E. GRAPHIC ARTS—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
BOOKBINDING—Continued				
Book design	1	1	----------	----------
Folding techniques	1	2	1	4
Types of adhesives used	1	1	2	4
Stitching and stapling procedures	1	1	1	1
Types of tools and materials	1	1	----------	----------
Suitable glues and paste	1	1	----------	----------
Kinds of sewing	1	1	----------	----------
Lettering or decorating	----------	----------	2	6
PAPER AND PAPERMAKING				
Papermaking in industry	5	8	3	4
Selecting paper suitable for specific uses	5	5	4	4
Classification of modern papers and their uses	4	4	2	2
Cutting and packing	4	13	3	4
Figure paper stock	3	3	1	1
Location of the papermaking industry	2	2	----------	----------
Making the paper (draining, sizing, rolling)	2	4	----------	----------
Obtaining the raw materials and making the pulp	2	4	----------	----------
Fold paper properly	2	3	2	2
Mixing coloring and special ingredients into the pulp	2	3	----------	----------
Standard finishes, weights, sizes, and packaged units of paper	2	4	2	5
Types of paper and how to select them	2	4	----------	----------
Identify types of paper	1	1	----------	----------
Marbelize paper	1	1	----------	----------
Figure and cutting paper	1	2	1	3
Correct use of paper cutter	1	2	----------	----------
Selecting and mixing pulp ingredients	1	1	----------	----------
History of papermaking	1	2	1	2
The making of papyrus	1	1	1	2
Logging and pulpmaking industries	1	1	----------	----------
Paper storage	----------	----------	1	2
Postal regulations	----------	----------	1	2
Paper merchandising	----------	----------	1	2
PHOTOGRAPHIC PROCESSES (PHOTOGRAPHY, PHOTOCOPYING, PHOTOSTATING, DUPLICATING AND REPRODUCTION, OZALID PRINTING, BLUEPRINTING)				
Printing and developing the copy print, enlargement, slide, ozalid, blueprint, plate or master	5	14	4	12
Adjusting the camera or instrument and taking the picture or making the copy	5	13	3	4
Developing the film and touching up the negative	5	17	3	3
Selecting and/or preparing the subject to be photographed or copied	4	6	3	5
Selecting and mixing appropriate developers, fixers, and their agents	3	6	2	4
Composition	3	4	2	2
Mount pictures	2	3	1	2
Construct a pinhole camera	2	2	1	1
Uses and importance of photography, photocopying, and photostating in graphic arts and everyday life	2	3	2	3
Important types of cameras available today	2	2	----------	----------
Understanding and choosing the camera or instrument most suitable for the type of photography or copy work to be done	2	3	1	3
Principles of photography	2	3	2	5
Selecting the appropriate film or plates for the purpose	2	2	2	3

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

E. GRAPHIC ARTS—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
PHOTOGRAPHIC PROCESSES (PHOTOGRAPHY, PHOTOCOPYING, PHOTOSTATING, DUPLICATING AND REPRODUCTION, OZALID PRINTING, BLUEPRINTING)—Con.				
Choosing the paper with the most appropriate contrast and finish	2	2	2	3
Meters and their uses	2	2	1	1
Stapling or stitching	1	8	2	11
Techniques of enlarging	1	2	1	1
Photography by artificial light	1	1	1	2
Color in photography	1	1	1	3
Principles of photographic display	1	1	1	3
Touch up methods and their uses	1	1	1	1
Method of making blueprints	1	1	-------	-------
Photography as a hobby	1	1	-------	-------
Principle parts of a camera	1	1	-------	-------
Light sensitive chemicals	1	1	-------	-------
History of picture making	1	1	-------	-------
Make multiple reproductions	-------	-------	1	1
Uses and importance of blueprints and ozalid printing	-------	-------	1	2
Career possibilities in photographic industries	-------	-------	1	1
Photography in science, medicine, industry	-------	-------	1	1
Toning processes	-------	-------	1	2
Technique of copy photography and photocopy work	-------	-------	1	2
Filters and their uses	-------	-------	1	1
Lens system	-------	-------	1	1
DUPLICATING (SPIRIT, HECTOGRAPH)				
Preparing the master copy	3	4	2	2
Duplicating and reproduction	3	4	2	2
Making the design and/or layout	2	3	2	2
Uses and advantages of duplicating methods	2	2	1	2
Operating gelatin hectograph and spirit duplicator	2	4	-------	-------
Clean machinery	1	1	1	1
Reproduce a drawing	1	2	-------	-------
Cost of duplicating by a variety of methods	1	2	-------	-------
Types of characteristics of duplicating machines	1	1	-------	-------
Methods of preparing the master	1	3	-------	-------
The principle of hectograph and spirit duplicating	1	2	-------	-------
Chemistry of plates and fluids	-------	-------	1	1
LITHOGRAPHIC OFFSET PRINTING				
Making the plates (direct image and photographic processes)	1	1	3	6
Printing or duplicating	1	1	3	5
Uses and importance of lithographic printing	1	1	1	1
Composing and printed matter	1	1	3	3
Making the layout and art work	1	1	3	3
Clean and care for equipment	-------	-------	1	4
Kinds of plates used, individual advantages, uses	-------	-------	1	1
Stone lithography and its historical and present day importance	-------	-------	1	1
Lithographic chemistry	-------	-------	1	1
Careers in lithographic printing and duplicating	-------	-------	1	1
Sensitizing, printing, and etching offset zinc plates	-------	-------	1	6
Techniques of composing by means of the varitype and the photo-composing machine	-------	-------	1	4
Methods and techniques of placing the image on the plate by direct image processes	-------	-------	1	3
Operating offset duplicators and the large offset processes usually found in the printing industry	-------	-------	1	2
Theory of the offset press	-------	-------	1	2

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

E. GRAPHIC ARTS—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
ETCHING AND GRAVURE PRINTING (INTAGLIO)				
Making the plate (drypoint, acid etching, engraving, photographic processes)	2	2	2	14
Printing (etching, photogravure, rotogravure)	1	1	1	4
Making the layout and/or design	1	1	3	4
Importance of intaglio methods (etching, drypoint, engraving, photogravure, rotogravure)	1	1	2	4
Types of intaglio printing	1	2	----------	----------
Industrial use of intaglio printing	1	2	----------	----------
The technique of photoengraving	----------	----------	2	2
Care for tools and equipment	1	1	----------	----------
Sharpen tools	----------	----------	1	2
Career opportunities	----------	----------	1	1
Methods and materials for etching and engraving	----------	----------	1	4
Kinds of plates used and their preparations	----------	----------	1	4
Styles of presses and their operation	----------	----------	1	2
Selecting and preparing the paper for etching	----------	----------	1	2
Engraving tools and their care	----------	----------	1	2
Photographic methods of preparing plates	----------	----------	1	1
INK				
Use ink properly	3	4	3	5
Mix colors	3	3	4	7
Select colored inks	2	3	2	4
Types of ink	1	2	----------	----------
Color principles and mixing of inks	1	1	----------	----------
History of ink making	1	1	----------	----------
F. TRANSPORTATION AND POWER MECHANICS				
BICYCLES				
Safety procedures	3	8	3	8
Disassemble, service, and clean parts	1	45	1	45
Replace parts	1	10	1	10
Bearings	1	3	1	3
Gear ratios, chain and pulley drives	1	1	1	1
Lubrication	1	1	1	1
SMALL GASOLINE MOTORS				
Disassemble, service and clean parts	2	5	2	5
Test and adjust parts	1	3	1	3
History and development	1	3	----------	----------
Assemble motor	1	1	1	2
AUTO MECHANICS				
Safety precautions	6	48	7	61
Remove, repair, and replace tubes	6	34	7	34
Check lighting circuit	5	24	6	29
Test and care for battery	5	18	6	21
Clean and adjust carburetor	5	16	6	18
Check and refill crankcase	5	16	6	17
Check and clean spark plugs	5	12	6	13
Inspect and repair fuel and vacuum pumps	5	12	6	15
Check generator circuit	5	11	6	13
Inspect and adjust differential and transmission	5	11	6	15

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

F. TRANSPORTATION AND POWER MECHANICS—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
AUTO MECHANICS—Continued				
Adjust valve lash	5	8	5	8
Adjust hydraulic brakes	5	8	6	12
Check ignition and paints	5	7	6	8
Realign and adjust clutch	5	7	6	10
Adjust wheel bearing	5	6	5	6
Check ignition coil	5	5	6	6
Clean and repair cooling system	4	16	5	17
Lubricate automobile	4	15	5	19
Preventive maintenance	4	15	4	15
Adjust headlights and others	4	15	5	16
Clean and repair gas line	4	7	4	7
Retouch damaged finish	4	7	5	8
Recondition valves	4	6	5	10
Adjust bearings	4	6	4	6
Adjust mechanical brakes	4	6	4	6
Clean and repair commutator	4	5	4	5
Inspect and repair steering gear	4	5	5	7
Check condenser	4	4	5	5
Make and install gaskets	4	4	5	6
Traffic laws	3	28	3	28
Wash and polish car	3	19	4	21
Occupational information	3	13	3	13
Inspect and realign brakes	3	10	4	12
Clean and repair upholstery	3	7	4	9
Set ignition timing	3	6	4	9
Remove, repair and replace wheel, drums, and axles	3	6	3	6
Inspect and repair starter	3	5	4	6
Check ignition circuit	3	5	3	6
Clean and inspect power plant	3	5	3	5
Check and repair pumps	3	5	4	7
Use electrical instruments	3	4	4	7
Recondition and inspect universal	3	4	4	5
Remove minor dents	3	4	4	7
Set valve timing	3	3	4	4
Align wheels	3	3	3	3
Remove bearing and gears	3	3	3	3
Driver training	2	31	2	31
History and development	2	15	3	18
Inspect springs and shock absorbers	2	9	3	11
Inspect mufflers and tailpipes	2	5	2	5
Insurance and license	2	4	3	5
Replace bearing	2	3	3	4
Check starting circuit	2	2	2	2
Install rings	2	2	3	4
Pour and scrape bearing	2	2	2	2
Trailers and trucks	2	2	2	2
Trouble shooting	1	16	1	11
Manufacture of automotive parts	1	10	2	11
Role of automobile in modern living	1	9	2	11
Purchasing	1	7	2	8
General servicing	1	2	2	11
Clean and repair gas tank	1	2	1	2
Clean and adjust ignition	1	1	1	1
Install valves	1	1	2	3
Inspect frames	1	1	1	1
Measurements	1	1	2	5
Use hand reamer	1	1	1	1

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

F. TRANSPORTATION AND POWER MECHANICS—Continued

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
1	2	3	4	5
Aeronautics and Aerodynamics				
Drafting and design	-----	-----	1	4
Parts of plane	1	1	1	1
Model construction	1	14	2	17
Application of principles	1	7	1	7
Aerodynamics	1	3	2	15
Aviation fundamentals	1	4	2	18
Civil air regulations	1	1	1	1
History of flight	1	2	2	3
Human flight factors	1	1	1	1
Meteorology	1	7	1	7
Power plants	1	2	1	2
Occupational data	1	1	1	1
Mechanics, Dynamics, and Power				
Applying and investigating scientific principles	1	51	1	51
Making models	1	16	1	16
Power generating systems	1	12	1	12
Operating equipment	1	21	1	21
Maintenance and repair	1	11	1	11
Testing circuits and units	1	1	1	1
History and development	1	12	1	12
Principles	1	58	1	58
Terminology	1	5	1	5
Economic factors	1	5	1	5
Social implications	1	3	1	3
Occupational data	1	1	1	1
Safety	1	3	1	3
Diesel Power				
Starting and operating	1	2	1	2
Testing	1	2	1	2
Maintenance	1	3	2	6

G. PLASTICS

Instructional topic	Grade level 7-8-9: Number of States and number of guides reporting topic	Grade level 7-8-9: Number of times reported	Grade level 10-11-12: Number of States and number of guides reporting topic	Grade level 10-11-12: Number of times reported
Designing				
Create a design	8	9	8	9
Make and read a working drawing	5	5	6	6
Working characteristics of plastics that affect design	3	5	3	5
Elements of good design	3	5	4	6
Types of finish that affect design	2	4	2	4
Types of assembly that affect design	2	3	2	
Planning				
Making an organized plan of procedure	6	6	6	6
Making a bill of materials	4	4	5	5
Layout and Measuring				
Making a layout on marked or unmarked plastic	12	18	10	12
Layout with a punch or punch holes	6	7	5	6
Using rules and instruments to measure	6	6	6	6
Developing and making a template or pattern	3	3	4	4
Layout with a template	2	3	2	3
Gauge a line	2	2	2	2

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

G. PLASTICS—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number o times reported
1	2	3	4	5
CUTTING				
Copying saw and jeweler's saw	12	18	10	11
Hand drill	10	23	9	20
Jig saw, hand saw, and metal cutting circular saw	11	15	10	13
Back saw and hack saw	10	13	9	11
Electric hand drill, drill press, and lathe	9	21	8	17
Planing and joining edges	8	12	8	13
Thread by machine	1	1	2	2
Heating and stamping	1	1	1	1
Tin snips and scissors	1	1	1	1
SHAPING				
Using heat to shape with jigs and fixtures	13	18	9	12
Using heat to shape by hand	11	16	8	11
Make a form for bending	2	2	2	2
Form by pressure	1	1	1	1
Grinding	1	1	----------	----------
CASTING				
Pouring into molds	6	6	4	8
Make a mold	2	2	2	3
Injection into molds	1	1	1	1
SMOOTHING				
Using abrasive materials	13	24	10	19
Filing and scraping	13	21	10	17
ASSEMBLING				
Solvents and cements	11	20	9	12
Self tapping, drive screws, or rivets	9	12	6	8
Attach fittings	6	10	4	6
Machine screws	6	6	6	6
With joints	5	15	4	14
Heat and pressure	3	5	2	2
Make forms for cementing	2	2	1	1
FINISHING				
Machine buffing	12	16	9	12
Hard polishing	8	13	3	5
Clean plastics	2	2	2	2
DECORATING				
Carving	10	13	10	14
Engraving	8	13	6	9
Dye	7	7	6	6
Novelty lacquers	6	6	4	4
Inlay	6	6	6	6
Overlay	5	5	4	4
Cold dip colors	4	5	2	2
Hot water colors	4	5	2	2
Etching	4	4	3	3
Laminating	3	3	3	3
Frosting	2	2	3	3
Imbedding	2	2	2	2
Apply filler	1	1	2	2
Applying decals	1	1	1	1

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequency of reporting, and by grade level: 1953–58—Continued

G. PLASTICS—Continued

Instructional topic	Grade level: 7-8-9		Grade level: 10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
Decorating—Continued				
Sandblasting	1	1	1	1
Embossing	1	1	1	1
Silk screen	1	1	1	1
Gold leaf	1	1	1	1
Types of Plastic Materials				
Natural	8	10	6	6
Thermosetting	9	12	6	6
Thermoplastics	8	10	6	6
Research and development in plastics	5	7	5	7
Sources of materials	4	4	2	2
Manufacture of Plastic Materials				
Production of sheets, shapes, rods, tubes, and molded plastic objects	10	11	7	7
Cost of plastics	4	4	4	4
Characteristics of Plastics				
History of plastics	11	12	8	8
Properties of different plastic materials	11	17	9	14
Common kinds and shapes of plastics	11	15	8	8
Comparison of working qualities	8	10	8	9
Use of Plastics				
Use of plastics in home construction, appliances, personal accessories, housewares, automobiles, airplanes	12	29	9	18
How to select plastic products	2	3	1	1
How and where plastics are purchased	2	2	2	3
Occupational Information				
Job opportunities	7	7	7	7
Types of jobs	4	4	5	5
Fields of plastic occupations	3	3	4	4
Wages and working conditions	3	3	4	4
Number and kinds of workers	2	2	3	3
Kinds of manufacturing concerns	2	2	3	3
Home Workshop Information				
Selection and use of tools and machines	4	6	3	5
Hobby or avocational activities	3	5	2	3
Layout	1	1	1	1
Home repair	1	1	1	1
Types of Tools and Equipment				
Metal fittings	8	12	6	8
Cement and cement dyes	8	13	5	5
Abrasive materials	6	7	5	5
Methods of decorating	5	13	2	10
Speeds and feeds	5	5	5	5
Hand tools	4	16	3	13
Bending mats	3	3	2	2
Making, bending and forming equipment	2	3	2	3
Casting	2	8	1	7
Principles and practices of machine tool utilization	1	4	1	4

Table 2.—Instructional topics reported in 39 industrial arts State curriculum guides of 22 States, by subject area, according to frequncey of reporting, and by grade level: 1953–58—Continued

G. PLASTICS—Continued

Instructional topic	Grade level			
	7-8-9		10-11-12	
	Number of States and number of guides reporting topic	Number of times reported	Number of States and number of guides reporting topic	Number of times reported
1	2	3	4	5
TYPES OF TOOLS AND EQUIPMENT—Continued				
Types of joints	1	2	1	2
Speeds and feeds	1	1	1	1
Lubricants and coolants	1	1	1	1
Principles of layouts	1	1	1	1
CARE AND SAFETY IN PLASTICS				
Safe procedures of operation of tools and machines	3	3	3	3
Care and maintenance of tools, machines and equipment	5	6	4	5
Storage and handling of supplies and inflammable materials	3	5	2	2
Shop rules and regulations	1	1	2	2

Inferences Derived From the Analysis

The following inferences apply in general to the overall study and not to any specific guide; they reflect apparent tendencies of the group of curriculum guides as a whole. These statements are drawn both from the data and from observations as the analysis proceeded.

1. In some of the industrial arts areas considered in this study, there appeared to be no consistent pattern of content materials which indicated a well-defined scope of subject matter.

2. There was little evidence that the instructional content of the curriculum guides reflected a developmental sequence of subject matter. This was particularly noticeable in the guides for junior high and senior high school levels.

3. Several of the States are faced with a complexity of organization of industrial arts laboratories which makes successful organization of a curriculum extremely difficult. An example would be attempts to consolidate content so that it could be used in general shops, unit shops, home mechanics, and farm shops.

4. An examination of the curriculum guides reveals very little agreement as to the grade placement of particular content or the activities that are appropriate to it.

5. There appeared to be a tendency for groups of contiguous States to develop guides which were similar in organization and content, although not published at the same time.

6. The curriculum guides of several States nonadjacent to each other had considerable resemblance as to organization and content recommendations.

7. A number of the guides utilized the same basic content as that presented in the bulletin, *A Guide to Improving Instruction in Industrial Arts*. The 1945 and the 1953 editions of this publication apparently were of assistance.

8. It appeared that many of the State publications were developed by an "analysis approach"; however, the content seemed to be judgmental in nature with a prevocational-type emphasis.

9. The common organizational format involved operational skills and information to be learned. The latter was of a general related type, general technical, or guidance information.

10. There appeared to be no general attempt to direct the content of the guides toward a pupil-centered, a socially oriented, or a problem based approach to curriculum building.

11. There was considerable difference between the apparent direction of some of the stated objectives and the companion content organization. The differences existed between behaviorally stated objectives and content set forth in a prevocational aura.

12. The content analysis revealed few significant attempts toward the promotion of methodology involving group activities, problem-solving, experimentation, research, and the like.

13. In almost every instance the content suggested was ordered about the nature of a material, such as, wood, metal, etc., and its manufacture or processing.

14. The significant differences which tended to exist among the various guides were few in number. There seemed to be few regional characteristics that were unique to certain areas of the Nation. Exceptions to this were such as an emphasis upon leathercraft in the Western United States or the inclusion of farm shops in agricultural areas.

Chapter II Content Presentation, Patterns of Organization, and Main Elements

CHAPTER II is devoted to the secondary purpose of this study, which contains two parts: Part A—Representative examples of how the instructional content is presented in the guides. A summary of the State pattern of organization for industrial arts is also given preceding each example; and Part B—An analysis of the main elements in the 39 State curriculum guides.

Each of the two parts of the secondary purpose provides additional information as to the nature, scope, and sequence of the total program of industrial arts as it is conceived in the State guides. The delimitations imposed on this study prevent the summary of data other than that reported in the 39 guides. A complete list of the State curriculum guides used in this study is given in the bibliography.

Part A. Representative examples of how the instructional content is presented in the curriculum guides with a summary of the State organizational pattern for industrial arts

Because of the nature of the analysis reported in Chapter I, the manner in which the instructional content is presented in the curriculum guides was not apparent. Therefore, to show this, several examples of subject areas were selected from the guides with a brief description explaining specific details about the format or presentation used.

The descriptions of the 10 examples provide some details about the outline followed in presenting the instructional content. The outline provides clues as to the overall thinking that went into the development of the instructional material. The subject areas represented are drawing and planning, woodworking, metalworking, electricity and radio (electronics), graphic arts, transportation and power mechanics, and plastics. Two illustrations of how States present the content are shown for the subject area of woodworking, and three illustrations for the subject area of electricity and radio (electronics). These additional examples from the guides graphically present the different forms used even in the same subject area. The various examples selected are not intended to be complete, but only to illustrate in a representative way the manner in which the instructional content is presented in the guides.

Preceding each example is a summary of the State organizational pattern for industrial arts. This provides a more comprehensive setting so as to understand the content presentation better. The 39 curriculum guides were analyzed for data revealing, for example, the number and length of periods per day, the number of weeks recommended in each of the subject areas, and the general organizational plan or pattern. Not all the 39 guides contained this information. For example, the curriculum guides from Pennsylvania and Minnesota, during the period of the analysis (1953–58), did not report their complete State organizational patterns again, but referred to bulletins which were published at an earlier date which contained this information; therefore, the summary of the State organizational patterns for the examples selected is not to be considered complete because of the delimitations imposed on the study.

CALIFORNIA

California industrial arts courses are arranged in four levels. Levels I and II are designated for the junior high school and Levels III and IV for the senior high school. The first level contains the beginning courses and they are of a broad exploratory nature. The other levels give students greater depth of understanding in the industrial arts as they progress during their years in school.

Two to four semesters in grades 7 and 8 are used for the *exploratory*, Level I, courses. This provides 5 to 10 weeks of instruction in exploratory courses covering subject areas in planning and drawing, woodwork, general metal, electricity, handicrafts, and graphic arts. Any remaining time in the eighth grade and all the time in the ninth grade in industrial arts is elective.

Level II contains what is called the *basic* courses. This level of courses covers the areas of planning and drafting, woodwork, general metal, electricity, handicrafts, graphic arts, and the comprehensive general shop. In the basic Level II courses, the student elects the industrial arts *subject* area of his choice. However, when a student has completed 2 semesters beyond a Level I course, in any one area, it is recommended that he elect some other industrial arts subject area.

The course of instruction for the senior high school level, grades 10–12, is arranged in two levels, III and IV. Level III contains *intermediate* elective courses for grades 10–12. This level offers more advanced experiences in a single industrial arts subject area. The choice of subject areas are auto mechanics, drafting, electricity-radio (electronics), graphic arts, handicrafts, metal (general), photography, and wood (general). Level IV contains *advanced* elective courses, grades 11–12. This level offers more specialized advanced work in a single industrial arts subject area with a prerequisite of Level III work in the same area. The subject areas in Level IV are the same as for Level III.

An excerpt from the California curriculum guide [1] shows an example of the manner in which the industrial arts content is presented. This plan is followed in their junior and senior high school curriculum guides. The excerpt illustrates only a few of the topics under the basic course of instruction entitled, "General Metal" offered at Level II.

Notice that the introductory paragraphs point out the purpose of the course, outcomes, and description. The content is organized around the following headings: (1) Activities, skills, and processes; (2) Related technical functional information; (3) Suggested project areas; (4) Instructional aids; and (5) General information. These headings are arranged in columns in the guide.

Under the column entitled, "Activities, skills, and processes," suggestions are given for various activities to be performed by the student. Also, in this column are subheadings of planning, fabricating, assembling, and finishing. The subheadings contain 6 topics under planning, 17 under fabricating, 3 under assembling, and 8 under finishing. The second column labeled, "Related technical functional

General Metal

(Level II, Basic)

Emphasis—The development of skills in the use of hand tools and machines is emphasized with opportunity to review hand-tool skills previously acquired. New skills and new tools and machines are introduced in bench metal, sheet metal, metal casting, art metal, machine shop practice, and forging. Attention is directed toward the source, characteristics, and working qualities of iron, steel, copper, brass, aluminum, tin, and galvanized iron. Students participate actively in the operation and management of the shop.

Outcomes—Students should develop an understanding of the broad field of the metal trades and industries with a knowledge of the various ferrous and nonferrous metals used. They should develop a reasonable degree of skill and adopt safe practices in the use of hand tools and machines. They should develop ability to interpret and use blueprints and working drawings and develop skill in metalcraft activities which can be used as leisure and avocational pursuits.

Characteristics of the course—Pupils have an opportunity to do a wide variety of metal work. They select, plan, and build projects of their own choosing that meet needs in their homes and their recreational lives. Pupils take the responsibility for checking the roll, making out absence and tardy slips, responsibility for issuing tools and supplies, cleaning up the shop and equipment, and other duties that do not require the mature judgment of the teacher. Motion pictures of factory production are shown and visits to industrial plants are made where feasible. Reference books, magazines, instruction sheets, industrial displays, charts, film strips, and motion pictures are used.

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[1] *Suggested Courses of Instruction in Industrial Arts for the Junior High School Level*, p. 17–19.

Activities skills and processes	Related technical functional information	Suggested project areas	Instructional aids	General information
Planning 1. Interpret working drawings. 2. Make sketches of projects. 3. Select and design projects. 4. Compute quantity and cost of materials for projects. 5. Plan operational procedures. 6. Layout with scriber, combination square, center punch, dividers, and hammer. *Fabricating* 1. Shear sheet metal with snips, chisels, and squaring shears.	*Safe practices in the use and care of tools, equipment, and supplies* 1. Elements of good design. 2. Machine operations and limitations. 3. Metal identification, applications, cost, and properties (aluminum, brass, copper, galvanized iron, iron, steel, and tinplate).	1. Auto and bicycle accessories. 2. Home workshop tools and equipment. 3. Kitchen utensils and gadgets. 4. Home decorative goods. 5. Jewelry. 6. Garden tools and equipment.	1. Charts: sample job sheets, designs and and sketches, hand tools(nomenclature and use), solders, fluxes, diagrams for machine tools. 2. Films: industrial plants (operations and processes), metal production, assembly industries. 3. Field trips: novelty shops, foundries, machine shops, ornamental iron works, tool supply companies, paint shops, platings shops.	1. Occupational orientation: drafting and design, layout man, machinist, machine tool operator, sheet metal worker, foundryman, heat treater, tool maintenance man, assembler (auto, appliance, aircraft), welder, riveter, painter, plater. 2. Metal sources, production, distribution, and conservation. 3. New developments in metals and production tools. 4. Production machines for mass production in shearing, sawing, drilling, filing, threading, bending, and forming.

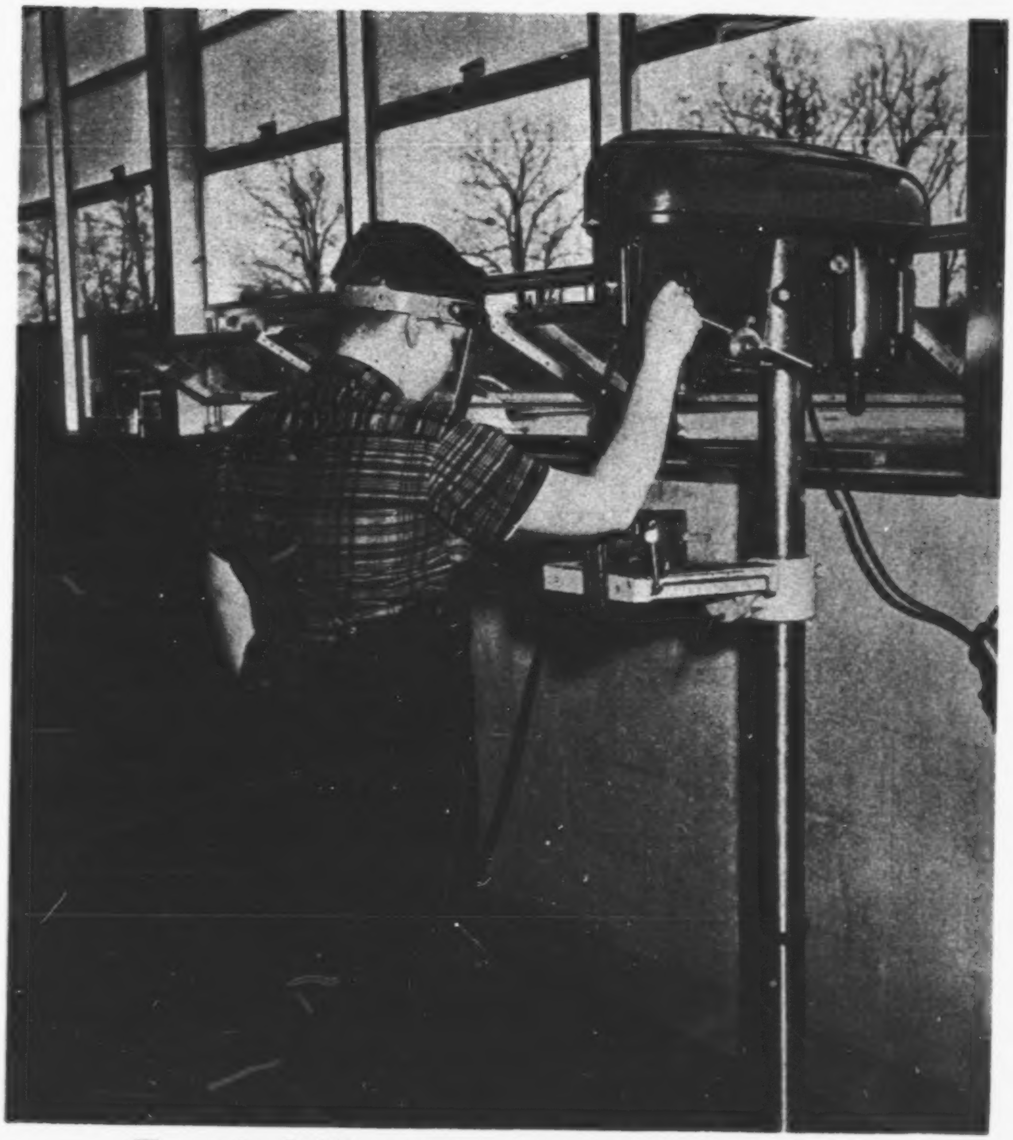

Figure 1.—Drilling a hole with a machine drill press.

information" is related to topics listed under activities, skills, and processes, and contains many topics of a technical information nature.

The third column entitled, "Suggested project areas" is set apart from the first two columns, and indicates where ideas for projects can be obtained rather than particular projects for students to construct. The fourth column entitled, "Instructional aids" lists specific commercial instructional aids. The fifth column entitled, "General information" has the type of information which is deemed desirable for the student to know although not necessary for the performance of the activities listed in column one.

IDAHO

Idaho has three basic plans of organization for general shop courses. These plans are set up for a school term of 36 weeks for grades 7–12.

Plan I.—All students take drawing for 8 weeks. Then the class is divided into 3 groups. These groups are rotated every 8 weeks in the subject areas of wood, metal, and electricity. In the last 4 weeks, students are allowed to continue in the most interesting area or finish incomplete projects.

Plan II.—All students take drawing and planning for 9 weeks. Then the class is divided into 3 groups, and each group is rotated every 9 weeks in the subject areas of wood, metal, and electricity.

Plan III.—Classes are divided into 4 groups and rotated every 9 weeks in the subject areas of wood, drawing, electricity, and metal.

The instructional content in Idaho is prepared in 4 major subject areas for the composite general shop and in the general unit shop. These areas are: (1) woodworking, (2) drawing, (3) electricity, and (4) metalworking. The following outline for content in woodworking for the composite general shop is as follows: overview, objectives for woodworking, instructional activities, things a student should be able to do, things a student should know, safety, suggested tools and equipment, power and tool equipment, suggested woodworking projects, and references.

In the areas of drawing, electricity, and metalworking, the outline is the same with the exception of metalworking which has an added item dealing with machines.

The following outline for content in woodworking in the general unit shop is as follows: overview, objectives, instructional activities, things a student should know, power machine section, safety, tool and equipment list, power tool equipment, suggested projects, references, and a floor plan for 20 students.

In the areas of drawing, electricity, and metalworking, the outline is similar to that for woodworking.

An excerpt of the instructional content in a general unit woodworking course follows: [2]

Things a Student Should Be Able To Do

1. Read a working drawing.
2. Make a bill of material.
3. Plan procedures in doing jobs.
4. Check issued materials.
5. Measure and divide spaces with common rules.
6. Lay out patterns or templates on stocks.
7. Check various layouts.
8. Lay out curves with a compass or divider.
9. Divide spaces with a divider.
10. The use of trammel points.

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[2] *Industrial Arts Study Guide for Grades 7-12*, p. 56.

THINGS A STUDENT SHOULD KNOW

1. The meaning of all symbols, lines, and detailed specification found in common working drawings.
2. How to choose material correctly for a job and to figure the cost of material.
3. The importance of planning in the shop as it is done in industry.
4. Characteristics, uses, sources of kinds of wood used in furniture, and grades of lumber.
5. Standard dimensions of lumber and cutting with a minimum of waste

MAINE

Maine industrial arts courses are arranged in three levels. Level I, covers introductory basic courses; Level II, covers intermediate courses; and Level III, covers advanced courses. Each of these levels is represented in the subject areas of electricity, metalwork, transportation, and woodwork.

No attempt is made to associate the levels with any particular grades, inasmuch as basic work may be given at any grade level to any pupil who has had no previous experiences. The basic courses, Level I, are intended to provide introductory and/or exploratory experiences in a wide range of shop activities. Level II, intermediate courses, follows the basic program and provides further opportunity to explore

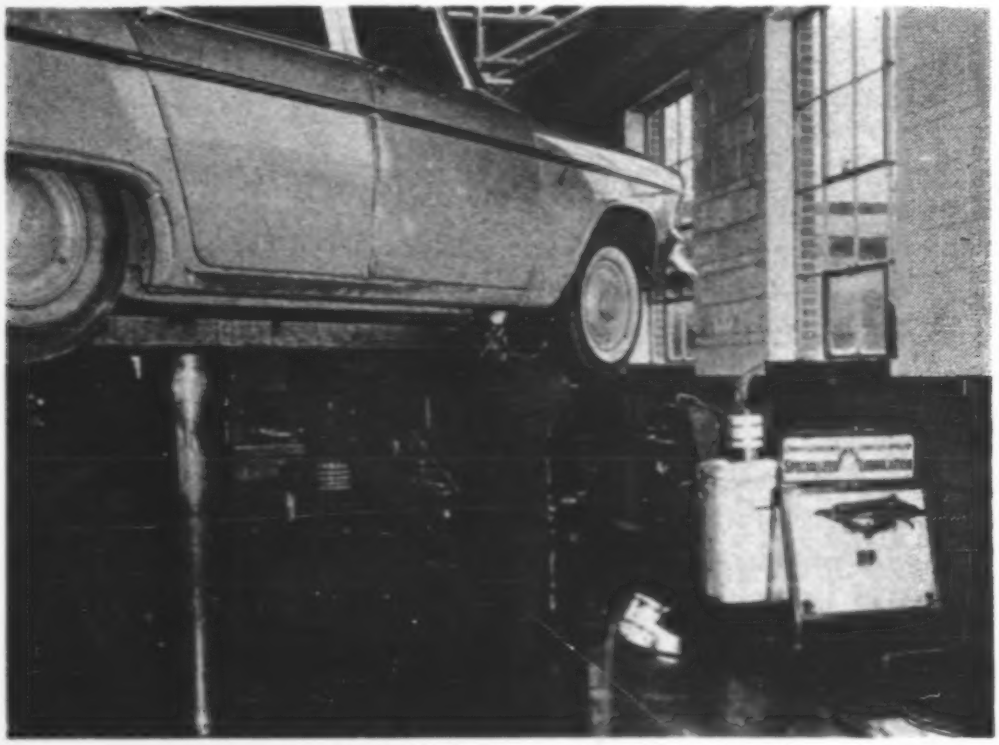

Figure 2.—Lubricating an automobile chassis.

students' interests and abilities. Level III, advanced courses, are prevocational in order to provide for those students who, by reason of their interest and choice, wish to develop their abilities in one or possibly two subject areas.

The instructional content in Maine is organized in four subject areas: (1) electricity, (2) metalwork, (3) transportation, and (4) woodwork. Each area has introductory paragraphs stating the general and specific objectives for that area, then three columns provide the suggested content under the following titles: "Suggested problems or activities," "New operations or processes," and "Related information." For example, in the transportation area "Suggested problems or activities" lists the following: (1) tires, (2) batteries, (3) generators, etc. A total of 14 different items are listed under this column in the actual guide. Under "New operations or processes" and "Related information" is a list of 14 suggested groups of content topics presented in a similar manner as in column one.

Notice an excerpt from the guide [3] for transportation, Level II. The

Transportation
(Level II)

Specific objectives

1. To develop the ability to choose wisely and to use carefully the internal combustion engine and common machines which are powered by it.
2. To develop basic skills and knowledges required in the maintenance of the internal combustion engine and common machines powered by it.
3. To develop attitudes, habits, and skills which will result in safe practices around the internal combustion engine and machines powered by it.
4. To provide opportunity to gain experiences with the tools, equipment, materials, and processes used in the repair and maintenance of the internal combustion engine and machines powered by it.
5. To develop an appreciation of the complexities involved in the manufacture of components of the internal combustion engine and machines powered by it.

Instructional guide

Suggested problems or activities	New operations or processes	Related information
1. Tires	1. Change to spare. 2. Remove, replace tube. 3. Test and repair tube	1. Types of jacks. 2. Safety factors involved in changing tires.
2. Batteries	1. Remove and replace. 2. Test with hydrometer. 3. Test with voltmeter.	1. Safety factors in handling and working around batteries. 2. Effects of corrosion.
3. Generator	1. Install brushes. 2. Remove and replace. 3. Adjust fan belt.	1. Relation between battery, generator, and regulator.

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[3] *Curriculum Guide-Industrial Arts in Maine*, p. 37.

pattern of organization presented is generally followed throughout the guide, except for the transportation area given at Level III. The first column is called "Unit" rather than "Suggested problems or activities." The "Unit" refers to various parts of the automobile, such as, (1) electrical; (2) fuel system; (3) lubrication; (4) cooling system, etc.

MINNESOTA

The curriculum guides from Minnesota used in this study during the period 1953–58 did not contain information about the State organizational pattern for industrial arts. Reference was made in the guides, however, to a previous publication dealing with the administration of industrial arts courses entitled, *A Guide for Instruction in Industrial Arts, Part I,* Administration Curriculum Bulletin No. 13, 1950. Since its publishing date is prior to the period specified in this study, it is not reported here.

The instructional content in Minnesota is organized by units in the various subject areas. For example, the teaching guide on electricity[4]

UNIT VI

Communications

Purpose:

1. To provide an understanding of the importance of communications to our everyday living.

Suitable activities:

1. Make telegraph key.
2. Make telegraph sounder.
3. Make pill box telephone.
4. Make crystal radio.
5. Make one tube radio.
6. Make five tube superheterodyne radio.
7. Make printed circuit radio.
8. Make record player.

Fundamental operations:

1. Make radio chassis.
2. Solder radio and telephone connections.
3. Wind radio coils.

Information units:

1. Theory of radio, AM and FM.
2. Development and theory of television.
3. Development and theory of sound recording and reproduction.
4. Governmental control of all communications.
5. Overseas transmission of messages by submarine cable.
6. Amateur radio.
7. Adjustment of TV receivers for picture quality.
8. Theory of (how it works) telephone transmitter, telephone receiver, telephone hook-ups, manual and automatic.
9. Occupations in communications.

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[4] *Teaching Guide for 8th and 9th Grade Electricity*, p. 14–15.

Displays:

1. Magneto telephone.
2. Television picture tube.
3. Schematic radio display board.
4. Tape recorder.
5. Telegraph key, sounder and relay.

Suggested Approach to This Unit

TEACHER APPROACH

1. Start unit out with radio since television and recording depend a great extent on radio fundamentals.
2. Follow with telephone portion of unit.

STUDENT ACTIVITIES

1. Build crystal set, one tube radio, visit radio station and radio repair shop.
2. Make a pill box telephone.
2a. Visit the telephone company.
3. Make telegraph key and sounder.
3a. Visit telegraph office.
3b. Study Morse code.

Evaluation:

1. Test for knowledge of radio symbols as shown in schematic diagrams.
2. Make usual entries on progress chart for mandatory and optional jobs and information units satisfactorily accomplished.
3. Test for knowledge of basic radio principles by drawing diagrams of receiver and sections of receivers.
4. Make teacher appraisal of workmanship.
5. Make telephone and telegraph theory tests.

for the eighth and ninth grades has six units: Unit I, magnetism; Unit II, flow of electricity; Unit III, heat from electricity; Unit IV, light from electricity; Unit V, power from electricity; and Unit VI, communications.

For each unit the pattern of organization is the same. For example, Unit VI, communications, contains main headings, such as, purpose, suitable activities, fundamental operations, information units, displays, suggested approach to this unit—for teacher approach and student activities, and evaluation.

A variation to the above pattern is found in the guide for "Plastics" and the guide for "Woodwork," where the units vary from that of electricity. The teaching guide on plastics (grades 7 and 8) has four units on plastics; and each unit is presented as follows: operations, information units, projects, alternate projects, materials needed, and references for projects and information units. In the teaching guide for eighth grade woodwork there are three units, and each unit is presented as follows: purpose, suggested projects, tools not previously used, fundamental operations not previously performed, and information units.

MISSOURI

Missouri industrial arts courses, for practical reasons, cover seven subject areas, although it is not implied that the instruction should be limited to these. The seven areas include: shop sketching, woodwork, metalwork, electricity, plastics, leatherwork, and ceramics. Two organizational plans are used. One plan is to offer the course on consecutive days for a given period of time; such as, a quarter, semester, or a whole year, and it may be alternated with various other school courses—art, music, and physical instruction. The second plan is to offer a course on alternating days—the seventh grade for 2 days and the eighth grade for 3 days per week.

The following excerpt [5] presents a graphic picture of the scope and sequence of industrial arts curriculums for junior and senior high schools. It suggests course, sequence, grade placement, and relationship of subjects in an industrial arts curriculum. The arrows indicate patterns of movement of the student through the program. It is understood that any individual student will take more than one curricular area, and in most cases, more than one subject in industrial arts.

The instructional content in the Missouri guides is presented in brief outline form. It is not intended to be complete, but should be used as a basic plan which the teacher can modify and enrich.

The outline is a suggested teaching plan which is arranged in five columns. The five column headings are: (1) Area of course (subject area); (2) Suggested projects, and sources of projects; (3) Demonstrations; (4) Topics for class discussion and special reports; and (5) Other activities. An excerpt from the guide [6] in the subject area of electricity illustrates their arrangement. Other subject areas or "Area of course" are: drawing, planning, and sketching; metalwork; woodwork; leather; plastic; and ceramics.

The topics listed in the columns are not in order or sequence for teaching, but are suggestive. The code B–204–205, for example, under the column heading "Demonstrations," refers to a reference book for the topic "Remove insulation." Each reference book is identified by a letter A-B-C, etc., followed by the page number(s). Under the column heading "Other activities" are suggestions for student activities that might be done for further enrichment.

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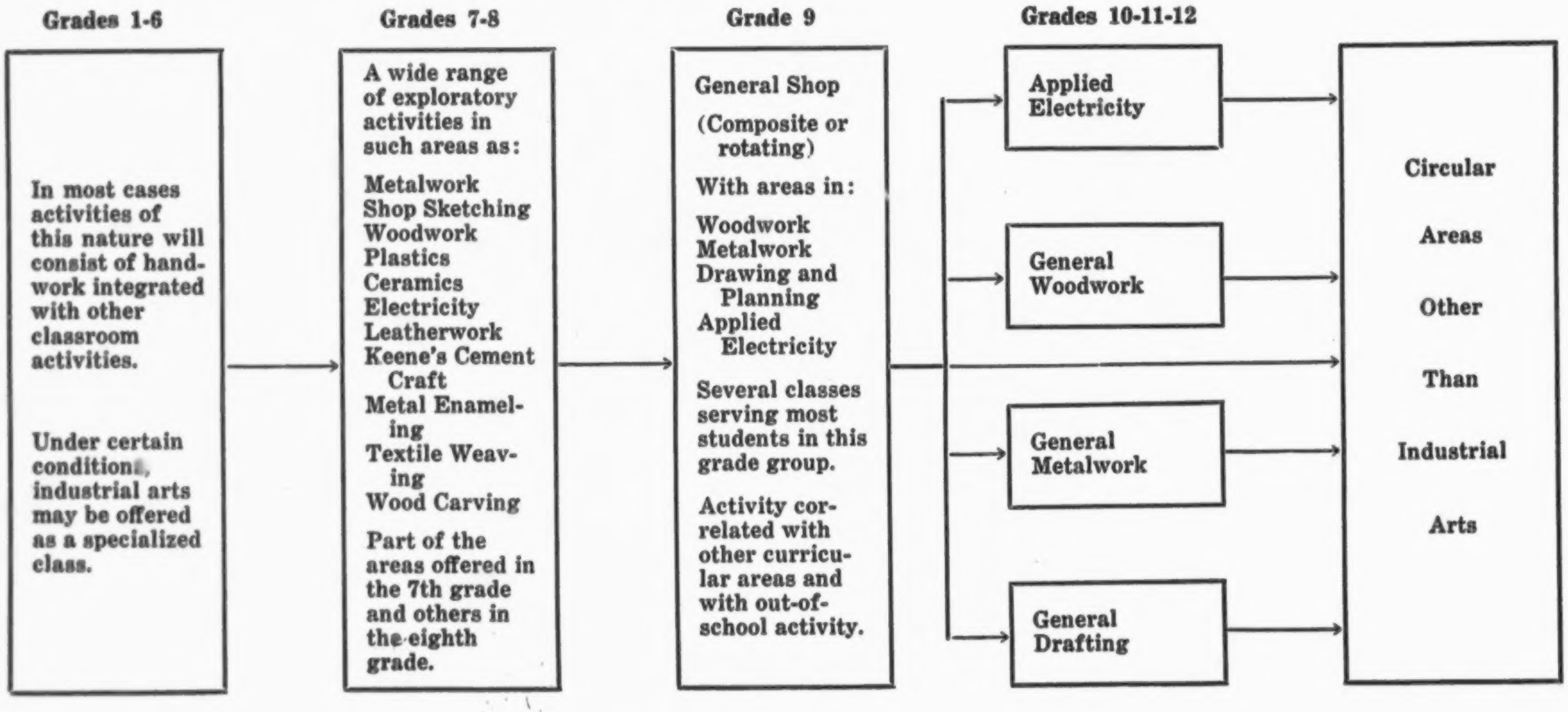
[5] *A Guide for Industrial Arts—Grades 7–8*, p. 27.

[6] Ibid., p. 45.

SCOPE AND SEQUENCE
OF
INDUSTRIAL ARTS CURRICULUM FOR JUNIOR AND SENIOR HIGH SCHOOL


Grades 1-6
In most cases activities of this nature will consist of handwork integrated with other classroom activities.
Under certain conditions, industrial arts may be offered as a specialized class.
Grades 7-8
A wide range of exploratory activities in such areas as:
Metalwork
Shop Sketching
Woodwork
Plastics
Ceramics
Electricity
Leatherwork
Keene's Cement Craft
Metal Enameling
Textile Weaving
Wood Carving
Part of the areas offered in the 7th grade and others in the eighth grade.
Grade 9
General Shop
(Composite or rotating)
With areas in:
Woodwork
Metalwork
Drawing and Planning
Applied Electricity
Several classes serving most students in this grade group.
Activity correlated with other curricular areas and with out-of-school activity.
Grades 10-11-12
Applied Electricity
General Woodwork
General Metalwork
General Drafting
Circular
Areas
Other
Than
Industrial
Arts

Suggested teaching plan

Area of course	Suggested projects and sources of projects	Demonstrations	Topics for class discussion and special reports	Other activities
1	2	3	4	5
Electricity	Magnetic compass, Job Assignment Sheet No. 18. Rewire a lamp, A–198. Electromagnet, A–178. Low voltage motor, B–214. Telegraph set, C–105–106. Crystal receiver, B–212. Low voltage rheostat, J–43. Crystal radio, J–89–90.	Remove insulation B–204–205. Make electrical splices B–206. Solder electrical connections, B–138. Tape electrical connections, B–206. Test voltage, amperage, and resistance, J–36–37. Wind a coil, C–105. Properties of conductors and insulators, A–175, B–180. Fasten wire under screws, B–204.	Safety precautions, J–84. How electricity is measured, A–185. How electricity is produced and transmitted, B–185–191. Electrical symbols, A–18. Developments in electricity, C–15–46.	Perform experiments in conjunction with the science class. Make parallel and series circuits using dry cells. Make a wet cell. Examine the construction of a dry cell. Trace the electrical circuit in a flashlight. Read a wiring diagram.

NEBRASKA

Nebraska industrial arts courses are designed specifically for grades 9 and 10, and can be adopted at the junior or at the senior high school level. Subject areas of drawing and planning, woodworking, metalworking, electricity, and general crafts (ceramics, leathercrafts, plastics, and art metal and jewelry) are reported in the guide.

Class periods consist of 1 hour or two 40-minute periods. Classes are scheduled for a semester with classes meeting five times a week, or they may meet fewer times per week. To complete the woodworking course of 14 units of instruction, the time allotted is 18 weeks with one period of 1 hour or two 40-minute periods, five times a week. Students are to complete a 3-week unit in drawing and planning prior to doing shop work.

The instructional content in the Nebraska guide[7] is organized under the following headings: introduction, course objectives for teaching a class, course content, units of instruction, equipment and supplies, and recommended policies. The excerpt shows one of the units of

Drawing and Planning

Introduction

Mechanical Drafting is the universal "language of industry." The ability to describe the shape and size of objects through drawings made by others is helpful to anyone regardless of his vocation. Without a knowledge of drafting and blueprint reading, many of the better jobs in industry are closed to workers. In this "age of industry," then, mechanical drafting is important in the education of both producers and consumers.

Course objectives for teaching a class in drawing and planning

1. To give training in reading and interpreting sketches and working drawings.
2. To provide experiences in the use of drafting instruments and materials in the performance of drafting fundamentals applied to the making of working drawings.

Course content

3-week unit:

  I. Freehand drafting in orthographic.
  II. Dimensioning and size descriptions and blueprint reading.

12-week unit:

  III. Lettering.
  IV. Instruments and their uses.
  V. Geometric constructions.
  VI. Orthographic projections.
  VII. Working drawings.
  VIII. Design of shop projects.
  IX. Complete units I–VIII, review subject matter and related information and test over these units.

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[7] *Industrial Arts for Nebraska Schools, An Instructional Guide*, pp. 29-30.

3-week unit:
- X. Elements of architectural drawing.
- XI. Home planning.

Units of instruction

Unit I—Freehand drafting in orthographic
- A. Unit objectives:
  - 1. To become acquainted with materials and methods used in making freehand sketches.
  - 2. To develop some skill in freehand pencil sketches.
- B. Subject matter information:
  - 1. Materials and instruments needed for sketching.
  - 2. Methods or techniques to be used in making sketches.
- C. Related information:
  - 1. The purpose and use of freehand sketches.
  - 2. Order of sketching or penciling.
  - 3. Knowledge of the different kinds of lines and their uses.
  - 4. How to check a sketch.
- D. Demonstrations:
  - 1. How to sharpen a drawing pencil.
  - 2. How to sketch vertical lines.
  - 3. How to sketch horizontal lines.
  - 4. How to sketch arcs and circles.
  - 5. How to mark points with a pencil.
  - 6. How to plan a sketch and make a layout sheet.

instruction for the subject area, drawing and planning. Notice that the units in the course content are divided into three periods of time—3 weeks are for Unit I, Freehand drafting in orthographic; and Unit II, Dimensioning and size descriptions and blueprint reading—12 weeks are for Units III through Unit IX (Unit III, Lettering; Unit IV, Instruments and their uses; Unit V, Geometric construction; Unit VI, Orthographic projections; Unit VII, Working drawing; Unit VIII, Design of shop projects; and Unit IX, Complete units I–VIII, Review subject matter and related information and test over these units). Three-week units are for Units X and XI, elements of agricultural drawing, and home planning, respectively.

Each of the units of instruction contains a title, objective, subject-matter information, related information, and demonstrations. Some of the units of instruction in other subject areas contain the heading, "Suggested activities and projects" and examples of the activities and projects are provided.

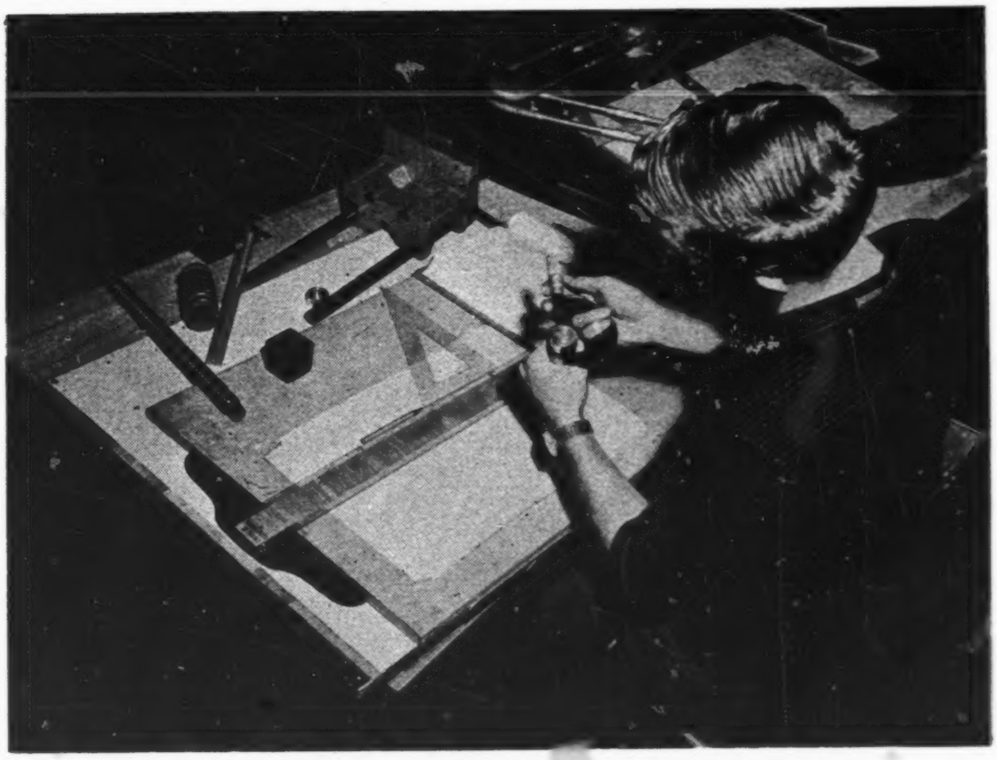

Figure 3.—Making a scale drawing of a cast iron vise.

NEW JERSEY

A guide for planning school facilities for the junior and senior high school in industrial arts is based on five general laboratories, and including six activities in one industrial arts laboratory. For example, General Laboratory I, would have activities in wood, leather, plastics, ceramics, home mechanics, and textiles. General Laboratory II would have machine shop, art metal, ornamental iron, sheet metal, and foundry. General Laboratory III would have electricity, internal combustion engine, refrigeration, radio and television. General Laboratory IV would have printing, silk screen, bookbinding, rubber stamp, blockprinting, and photography. General Laboratory V would have agriculture arts.

The instructional content suggested in New Jersey for elementary grades 5, 6, 7, and 8 is: grade 5—wood, metal, leather, and plastics; grade 6—wood, metal, leather, plastics, and electricity; grade 7— wood metal, leather, plastics, electricity, mechanical drawing, ceramics, and home mechanics; and grade 8—wood, metal, leather, plastics, electricity, mechanical drawing, ceramics, and home mechanics.

Additional areas may be included in an elementary industrial arts program: weaving, knotwork, beadwork, basketry, shell craft, metal enameling, jewelry, foundry, metal spinning, electroplating, lapidary,

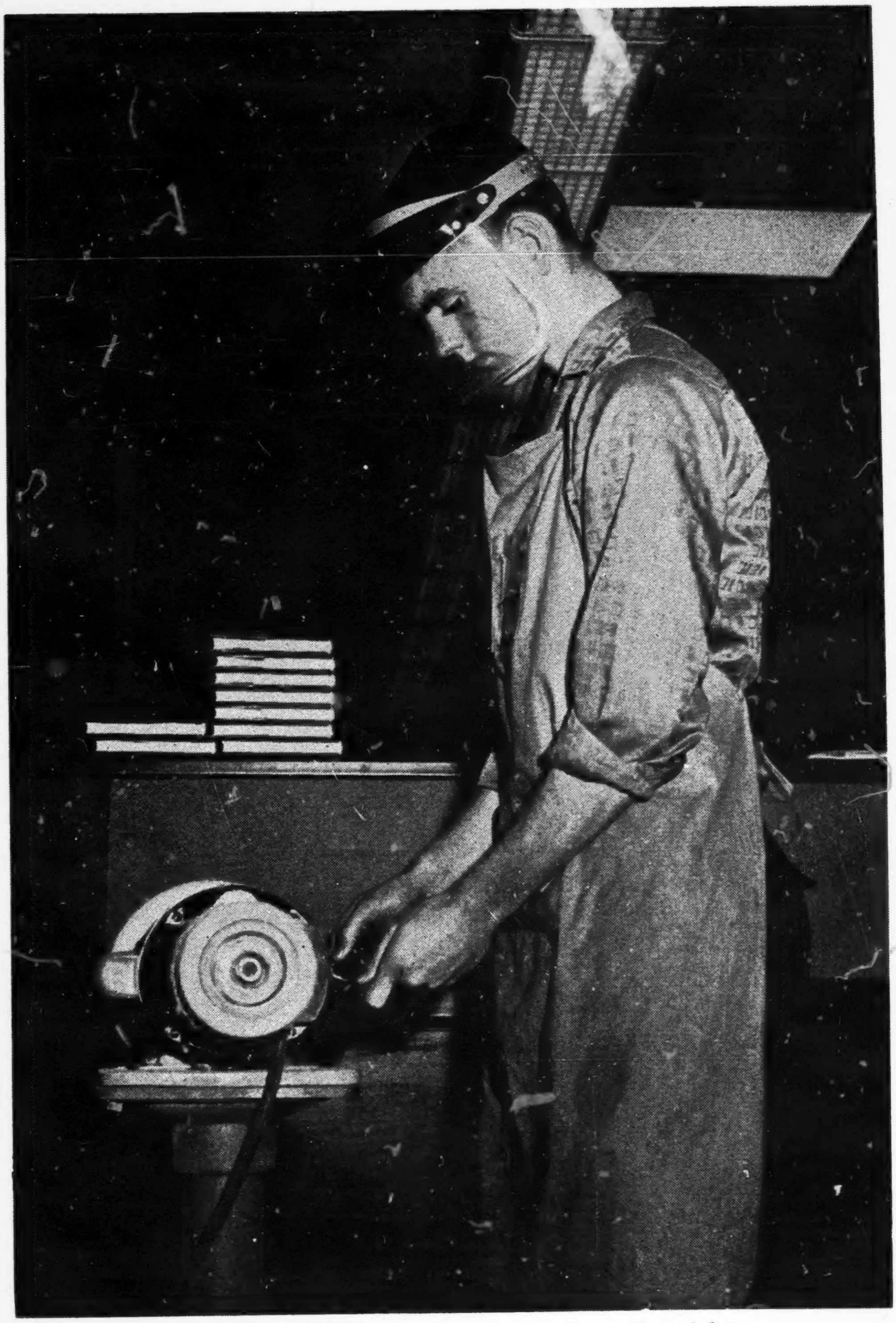

Figure 4.—Polishing a plastic top for a jewel box.

wood carving, whittling, wood burning, model planes and ships, upholstering, archery, bookbinding, silk screen work, blockprinting, photography, and keene cement work.

The format used in the presentation of each area includes five units: (1) tools and equipment, (2) materials and supplies, (3) skills and processes, (4) related information, and (5) suggested projects. An excerpt of the format of the curriculum guide[8] is shown as follows for the "plastics" area.

Plastics

UNIT I—TOOLS AND EQUIPMENT:

A. Rule
B. Try square
C. Coping saw
D. Back saw
E. Files
F. Hand drill
G. Prick punch

UNIT II—MATERIALS AND SUPPLIES:

A. Assorted plastic sheets
B. Assorted plastic rods
C. Special shaped plastics:
    1. Hearts
    2. Rings
    3. Cross
    4. Animals
D. Abrasive papers
E. Polishing compounds

UNIT III—SKILLS AND PROCESSES:

A. Prepare, measure, and lay out designs
B. Cut designs with saws
C. Use hand drill
D. Use files to dress edges
E. Use abrasive papers to smooth edges
F. Include hand polish project

UNIT IV—RELATED INFORMATION:

A. Types and uses of common plastics

UNIT V—SUGGESTED PROJECTS:

A. Napkin holders
B. Shade pulls
C. Simple jewelry—rings
D. Letter openers
E. Buttons
F. Door push plates

NEW YORK

New York industrial arts courses provide exploratory experiences for students in grades 7, 8, and 9. In the senior high school (grades 10, 11, and 12) students may take general and advanced courses on an elective basis. General woodwork, general electricity, general textiles, general printing, general metalwork, and general ceramics form the foundation for advanced courses in the upper levels of the senior high school.

The recommended time schedule for the different grades is as follows: grade 7—two double 45-minute periods per week, for 36 weeks, 108 clock hours, or 3 hours per week; grade 8—three double 45-minute periods per week, for 36 weeks, 162 clock hours, or 4½ hours per week; grade 9—three-five double 45-minute periods per week, for 36 weeks, 162–270 clock hours, or 4½–7½ hours per week; and grades

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[8] *Industrial Arts Teacher Guide for Elementary Grades*, p. 11.

10, 11, and 12—three-five double periods per week, for 36 weeks, 162–270 clock hours, or 4½–7½ hours per week.

A student should have a total of at least 430 clock hours of industrial arts experience in grades 7, 8, and 9. The comprehensive general shop consists of six subject areas of instruction: (1) general metalwork, (2) general electricity, (3) general printing, (4) general woodwork, (5) general textiles, and (6) general ceramics. In a junior high school with one comprehensive general shop each of the areas receive ⅙ of the total time. In a junior high school where there are several shops and several teachers, the students are rotated through courses during grades 7, 8, and 9 so that a general shop equivalency is obtained.

Regent credit.—Schools wishing to offer a 36-week course for regent credit may do so by filing with the State education department an application together with other required information. These 36-week courses are usually offered in the tenth, eleventh, and twelfth grades. In general electricity, if sufficient beginning work has been done in grades 7 and 8, a 36-week general electricity course may be offered in the ninth grade, although this is not usually done.

It is necessary to seek approval of courses which follow the State syllabuses as well as courses organized by local teachers.

Instructional content in industrial arts in New York State is organized in separate syllabuses for the various subject areas. Four monographs dealing with project ideas and related information have also been developed as supplements to these syllabuses.

In the general electricity syllabus the following organization is used: Section I, Description of the syllabus; Section II, Introduction, Part 1—Projects, Part 2—Operations and processes, Part 3—Demonstrations and related lesson topics; Section III, Introduction, Part1—Projects, Part 2—Operations and processes, Part 3—Demonstrations and related lesson topics; Section IV, Outside preparation; Section V, Records; and Section VI, Bibliography.

Section II, 18 weeks, includes beginning teaching content for grades 7, 8, and 9, and functions as one of six exploratory course outlines which comprise the comprehensive general shop equivalency. Section III, 36 weeks, is for high school grades 10, 11, and 12.

An example of the organization in the syllabus in general electricity under Section II, Part 1—Projects would include an introduction, explanation of a "take-home Projects," illustrations of construction projects in signal systems (sounder, key, and simple telephone), heating device (electric pencil, thermocouple, toaster element, etc.), magnets, control devices, etc. Suggestion for projects in testing; measuring and computing; installation, service or maintenance; kits and assembly-inspection work and others are also given. These suggestions provide a wide range of selection for the teacher to review.

Section II, Part 2—Operations and processes, has an overall introduction and then has instructional content suggestions listed under wire, testing and measuring, signal systems, lighting systems, household appliances, power systems, heating devices, magnets, electrochemistry, motors and generators, control devices, radio and electronic devices. An excerpt of the suggestions under Part 2—Operations and processes under the heading of *Magnets* follows:[8]

MAGNETS
To:
- Test permanent magnets for polarity with a compass
- Test magnetic and nonmagnetic substances
- Test polarity of electromagnet with a compass
- Vary strength of electromagnets
- Test solenoids for magnetic attraction

Section II, Part 3—Demonstrations and related lesson topics, contains an introduction, a chart on the distribution of the demonstrations and related lesson topics, explanation of how to present the demonstrations, and time devoted to them. The following excerpt shows the recommended distribution of these lessons.[9] The kinds of

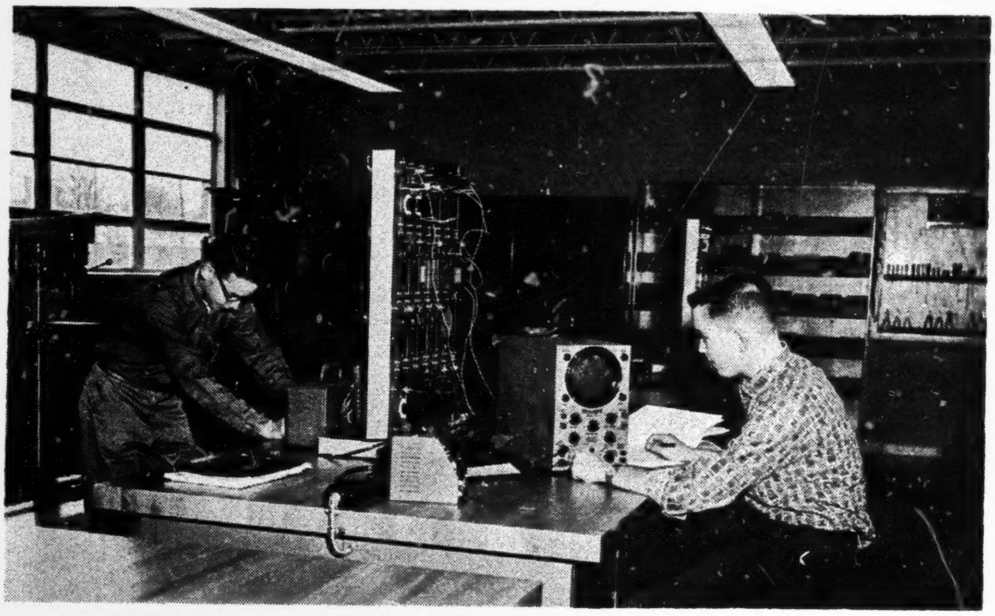

Figure 5.—Testing an electronic circuit with a signal generator and oscilloscope.

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[8] *Industrial Arts, Syllabus in General Electricity*, p. 33.
[9] Ibid., p. 35.

Distribution of demonstrations and related lesson topics

Kinds of lessons	*Number*
Demonstrations	43
Related lesson topics	65
Unassigned periods	0
Total	108

demonstrations suggested fall under the same headings as those for operations and processes, such as wire, testing and measuring, signal systems, magnets, etc. The demonstrations listed under the heading of *Magnets* is shown as follows:[10] Notice the direct relationship between the demonstrations, and the operations and processes under this heading.

MAGNETS
To:
- Test permanent magnets for polarity
- Test substances for magnetic attraction
- Test polarity of electromagnets
- Vary strength of electromagnets
- Test solenoids for magnetic attraction

Related lesson topics fall under six headings: planning, social economics, guidance, science, safety and hygiene, and consumer values. The following excerpt shows the kinds of lesson topics and the number suggested for each heading.[11]

Distribution of related lesson topics

Kinds of lesson topics	*Number*
Planning	12
Social economics	13
Guidance	10
Science	10
Safety and hygiene	6
Consumer values	14
Total	65

A specific example of the related lesson topics suggested under the heading of "consumer values" is shown as follows:[12]

CONSUMER VALUES
- How to select the proper heater and extension cords
- How to obtain the best and longest service from heater and extension cord
- Work electricity can do in the home
- Significance of the label of the Underwriters' Laboratories

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[10] Ibid., p. 39.
[11] Ibid., p. 41.
[12] Ibid., p. 43.

Consumer Values—Continued
- The purpose and correct size of fuses
- What constitues good lighting in the home
- What the lightmeter tells about adequacy of lighting
- Things a boy should know about Christmas tree lights
- Advantages and disadvantages of different types of house wiring
- Desirable locations for convenience outlets
- Desirability of adequate switching arrangements for the home
- Advantages and disadvantages of the electric range
- How to select the proper storage battery
- How to secure the best results from the radio
- Desirable electrical qualities in a radio
- How to light a home workshop properly
- How to select the proper grade, type, and size of electric motor

The 36-week course in the syllabus follows the same general pattern as do the other separate syllabuses for general ceramics, general printing, etc.

TEXAS

Texas industrial arts courses are arranged in four levels. Level I covers grades 1–6; Level II, grades 7–10; Level III, grades 9–12; and Level IV, grades 10–12.

Level I is generally taught in a self-contained classroom. Tools and instruction materials are brought into the classroom from the school, the home, and the community.

The exploratory industrial arts courses, Level II, range from grades 7 to 10 and provide a variety of experiences for the early adolescent child. Constructive activities, technical, and other related information are organized in a minimum of four industrial subject areas, with each pupil spending 6 to 9 weeks in each area. The subject areas may include woodworking, metalworking, graphic arts, drafting and planning, modelmaking, electricity, crafts, mechanics, drawing, and others. Many school districts offer crafts as the first exploratory course. At least two of the crafts, such as leatherwork, plastics, jewelry, ceramics, modelmaking, and carving should be included during each 9-week period.

Level III, grades 9–12, provide additional discovery experiences in a limited number of industrial arts subject areas following at least 1 year (36 weeks) of the exploratory courses. The general industrial arts courses for grades 9–12 are: general drafting, general woodworking, general crafts, general metalworking, general mechanics, general electricity, and general graphic arts. These courses are approved subject offerings and grade placement for accredited school districts, and offer from ¼ to 1 unit of credit for completing a course. The length of the class period is recommended to be 55 minutes. These courses do not require prerequisites.

Level IV, grades 10–12, is considered advanced industrial arts. These advanced courses should be taught *only* in those school districts where satisfactory exploration and/or general courses are offered and required as prerequisites. As a rule, one unit of exploratory or general industrial arts is a prerequisite to these advanced courses. An accredited school district can offer from ½ to 1, ½ to 2, and ½ to 3 units of credit for completing a course. The class period of 55 minutes is recommended for these courses. Thirty different courses are suggested for Level IV. Examples of the course titles are: architectural drafting, machine woodworking, welding, and automobile mechanics.

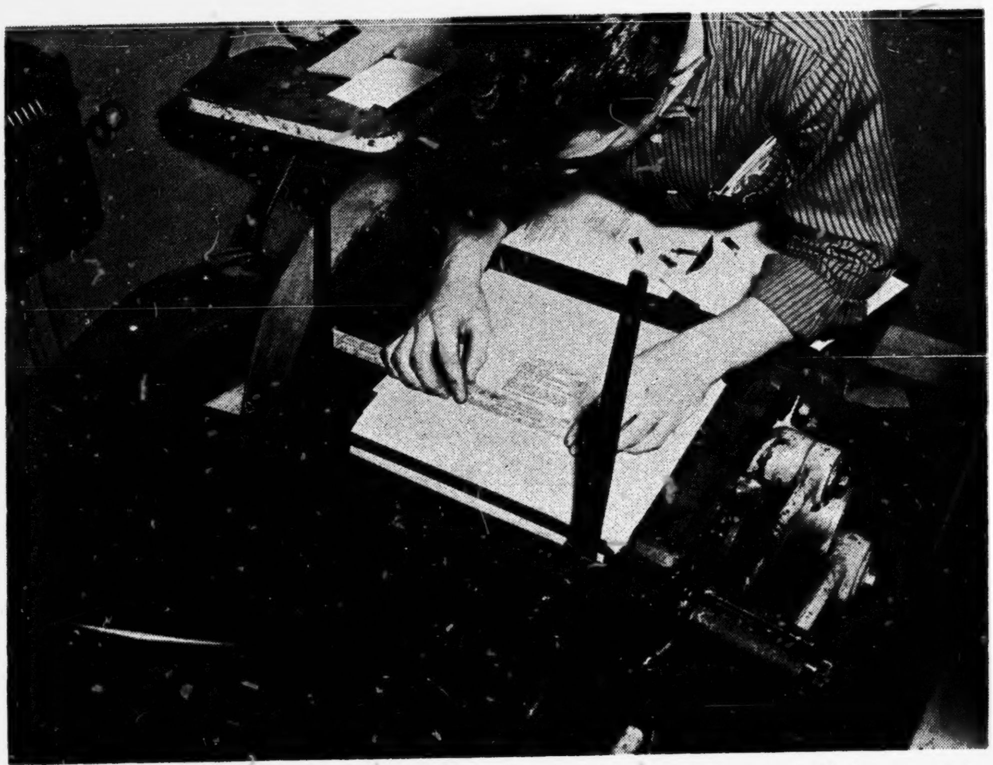

Figure 6.—Locating the "gauge pins" on the tympan of a platen press.

An example of the organizational content in the Texas curriculum guide[13] is shown in the excerpt for the area of graphic arts. This excerpt is at Level III, grades 9–12. An introduction explains the subject area and suggestions for content are given under "Processes" and "Related Study Topics."

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[13] *Industrial Arts in Texas Schools*, p. 55–56.

General Graphic Arts

(Grades 9–12, Level III)

Numerous opportunities are offered for correlating graphic arts experiences with work in other courses. Some type of correlation is helpful to both study areas. As an example, language arts and art activities capitalize on graphic arts interest.

General graphic arts courses utilize the broad field approach to curriculum development, including experiences in a variety of reproduction processes. This includes letterpress printing, offset printing, silk screen printing, spirit duplicating, bookbinding, photography, and similar processes using light-sensitive materials.

If courses beyond the general course are taught, they should be entitled advanced industrial arts.

Processes (for 36-week course): Study the origin and development of the graphic arts industries. Report on and discuss the scientific developments which have affected present day practices. Study the principles of graphic design and make layouts of each type of process to be done. Learn to recognize and discuss intelligently graphic arts products made by the processes studied.

Do letterpress printing—set type, make proofs, lockup forms, and operate handpress. Do offset printing—make plates by direct image and photographic processes; set up and operate offset machine.

Do silk screen printing—prepare stencil, mix colors, make duplicate prints, clean and care for equipment. Do linoleum block printing—cut and carve linoleum blocks, print the cut, clean and care for equipment.

Do photographic reproductions. Select camera, lens, and film; prepare subject, adjust camera, and lights, compose pictures; make exposures; develop film; make contact prints and enlargements; make multiple reproductions. Make reproductions by direct exposure of sensitized materials, blueprint, ozalid, blackline. Bind printed materials. Assemble single sheets and sections, trim the body, prepare the case, assemble case and body.

Related study topics: Influence of graphic arts upon present and past cultures . . . Materials and terminology used in graphic arts industries . . . Outstanding contributions to the growth and development of the graphic arts industries . . . Job opportunities . . . Safety practices . . . Principles of graphic reproductions . . . Caring for equipment.

VIRGINIA

Virginia industrial arts courses are offered at four levels. Level I, grade 8; Level II, grade 9; Level III, grade 10; and Level IV, grades 11 and 12.

In Level I, grade 8, three plans of organization are recommended depending on the number of weeks industrial arts is offered in the eighth grade. For example, industrial arts can be offered for 9, 12, or 18 weeks. The 18-week plan provides a selection of four subject areas, such as (1) metalwork; (2) woodwork; (3) choice of drawing, electricity, plastics, leatherwork, ceramics, graphic arts, textiles, and

Manipulative operation	Related information	Suggested references	Suggested projects
I. How to read a working drawing.	*Technical:* 1. Simple pictorial drawing. 2. Simple orthographic projection. *Guidance:* 1. The relationship of blueprint reading to woodworking industry. *General:* 1. Various methods of reproducing drawings.	1. *General Shop Woodworking*, by Fryklund and LaBerge, McKnight and McKnight Publishers, Bloomington, Ill. 2. *Woodwork Visualized*, by Ross C. Cramlet, The Bruce Publishing Company, Milwaukee, Wis. 3. *Principles of Woodworking*, by Herman Hjorth, The Bruce Publishing Company, Milwaukee, Wis. 4. *From Forest to Woodworker*, by Noble, Everill and Hill, The Bruce Publishing Company, Milwaukee, Wis.	Book ends. File box. Cigarette box. Small table. Lampstand. Magazine holder. Wall shelf. Knife holder. Footstool. Shoeshine box. Small spice cabinet.
II. How to measure with the rule.	*Technical:* 1. Divisions of an inch, foot, and yard. *General:* 1. Common woodworking rules. 2. Calculation of board measure.		
III. How to lay out stock.	*Technical:* 1. Use of the steel square and try square. 2. Measuring tools. *Guidance:* 1. Opportunities for layout men in various fields.		

IV. How to cut stock.	*General:* 1. The importance of accuracy in industry. *Technical:* 1. Types of woodcutting saws. *General:* 1. Making a bill of material. 2. Common types of wood used in woodworking.		

sketching; and (4) choice of the same as in number (3) with the exception of ceramics. The 12-week plan provides a selection of three areas, such as (1) metalwork; (2) woodwork; and (3) a choice of either drawing, electricity, plastics, leather, ceramics, graphic arts, textiles, and home mechanics. The 9-week plan has a selection of two areas, such as (1) metalwork and (2) woodwork. Students are rotated through all areas with approximately the same time in each area.

In the ninth grade industrial arts is elective and four areas are selected from the eighth-grade program for 36 weeks for 5 periods per week. A selection of one of the following elective subjects which constitutes a year's course (36 weeks), such as, general auto-mechanics, general metals, general woods, general drawing, general electricity, general graphic arts, general power mechanics, and general home mechanics is provided at the tenth-grade level. The time allotment is 5 periods per week.

The 10th- and 12th-grade courses are elective and concerned with a specific unit-type activity, such as, architectural drawing, automechanics, cabinetmaking, carpentry, electricity, machine shop, sheet metal, printing, radio, and welding. These courses are called advanced shop I and II. In electricity and woodworking, a beginning course can be offered for 18 weeks and an advanced course from 36 to 54 weeks.

It is permissible to combine the 10th- and 11th-, or 11th- and 12th-grade students in order to make a reasonable sized class. This means that a wider range of work must be planned. Double periods are recommended for these courses.

The instructional content in Virginia is organized under four columns entitled: (1) Manipulative operation, (2) Related information, (3) Suggested references, and (4) Suggested projects. A discussion dealing with the importance of woodworking in our industrial society and a list of objectives precede the instructional content suggested in the Virginia guide on woodworking.[14]

The *Manipulative operation* column has items, such as (1) How to read a working drawing, (2) How to measure with the rule, and (3) How to lay out stock, etc. The *Related information* column has content suggestions under the following headings: Technical information, Guidance information, and General information. Specific statements regarding content are given under these headings. For example, under "Technical information" are, Simple pictorial drawing, and Simple orthographic projection; the related information topics pertain to those statements given under the *Manipulative operation* column.

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[14] *Course Outline for Woodworking*, p. 15–19.

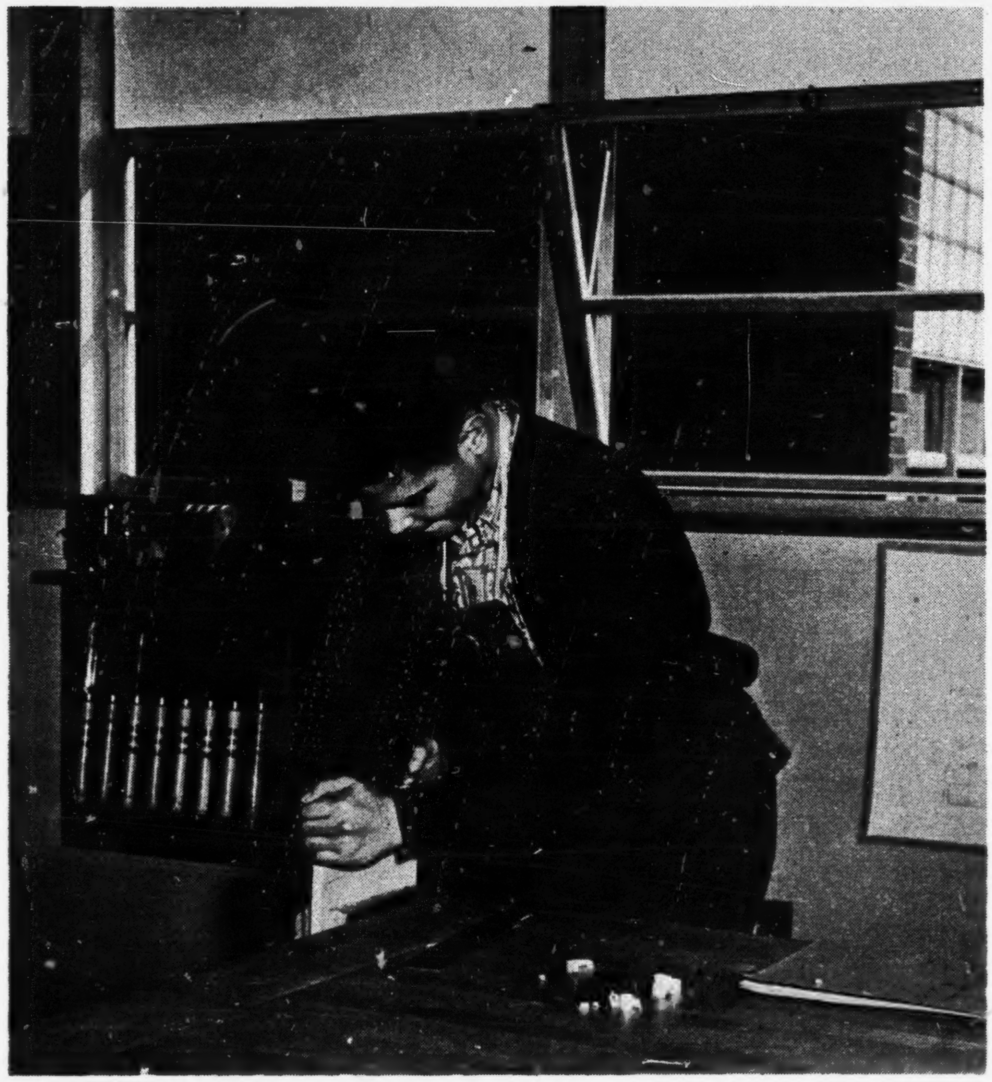

Figure 7.—Using a hand plane to smooth a wooden base for a project.

Under the column heading of *Suggested references*, several pertinent references are listed. The column *Suggested projects* contains many ideas for projects.

Part B Main Elements

In determining the main elements which make up the curriculum guides, an analysis was made of the table of contents in each of the 39 guides. The different divisions, chapters, and/or main headings listed in the table of contents provided the data for determining their fundamental features, or main elements which make up the guides. A tabulation of this analysis appears on page 63.

In deriving table 3 from the data provided in the table of contents from each guide only the main elements were sought. For example, no attempt was made to break down the teaching content into specific course objectives, student activities, operations, processes, etc. Therefore, these items relating specifically to teaching content were grouped under the main element of "instructional content," see Item 1. Likewise, Item 3, "bibliography" was considered the main element which includes books, references, pamphlets, films, and various teaching aids.

Examination of table 3, reveals that there are 12 main elements derived from the table of contents. They are:

1. Instructional content
2. Foreword
3. Bibliography
4. Administrative factors
5. Lists of tools and equipment
6. Purpose and philosophy of industrial arts
7. General objectives
8. Laboratory (shop) planning
9. Safety
10. Evaluation
11. Methods of teaching
12. Public relations

A majority of the guides contained the first four main elements. Although, the other main elements did not appear as frequently as the first four, this does not mean that individual States do not have, for example, information dealing with school-shop planning because another guide may be devoted to this main element, as is the case, in California and New Jersey. These two States have separate guides for planning and equipping industrial arts laboratories. Other States have special guides on safety. Because of the limitations in the analysis, it cannot be assumed if the frequency is low for any main element in table 3, that this element is not important or not covered in any one State. It does, however, indicate that the 39 curriculum guides used in this study, which deal with instructional content, also contain other main elements; and that these elements point to areas of concern which industrial arts personnel direct their attention to in the development of curriculum materials for industrial arts.

Table 3.—Main elements reported in table of contents in 39 industrial arts State curriculum guides, representing 22 States, 1953–58

Item No.	Main elements	Frequency
1	Instructional content (specific course objectives, units, projects, operations, processes, etc.)	[1] 32
2	Foreword (preface, introduction, acknowledgments)	25
3	Bibliography (books, pamphlets, teaching aids, films)	24
4	Administrative factors (organization and managment, forms, records)	17
5	Lists of tools and equipment	12
6	Purpose and philosophy of industrial arts	10
7	General objectives	8
8	Laboratory (shop) planning (layouts)	7
9	Safety	5
10	Evaluation (tests and check lists)	5
11	Methods of teaching	3
12	Public relations	1

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[1] While all 39 guides reported instructional content in industrial arts, seven (7) guides did not have a table of contents and were, therefore, not reported in the table.

Chapter III Summary, Conclusions, and Suggestions

Summary

THIS STUDY reports (1) an analysis of the instructional content in selected subject areas of industrial arts State curriculum guides for the junior high school (grades 7, 8, and 9) and for the senior high school (grades 10, 11, and 12); (2) selected examples of how the instructional content is presented in the State guides accompanied with a summary of the State pattern of organization for industrial arts; and (3) the main elements which make up the curriculum guides.

The analysis of the instructional content involves 39 State curriculum guides published from 1953 to 1958, representing 22 States and is reported in Chapter I. The selected subject areas in industrial arts for which the analysis reports are (1) drawing and planning, (2) woodworking, (3) metalworking, (4) electricity and radio (electronics), (5) graphic arts, (6) transportation and power mechanics, and (7) plastics.

The instructional content is defined as a topic represented by a meaning phrase, or statement which was adjudged to contain suitable instruction for industrial arts. These topics are ordered into categories which represent various similar topic groupings or classifications within each subject area selected for the study. Thus, it was possible to obtain a range of categories and topics within categories, both for junior and senior high school grades. A tabulation was made of frequency of mention of each topic in each guide and for each State as an emphasis identifier.

Chapter II shows representative examples of how the instructional content is presented in the curriculum guides. Included with each example is the State organizational pattern for industrial arts. The examples show the variety that exists in the way in which the instructional content is presented. The examples of State organizational patterns indicate that the laboratories in industrial arts provide experiences in construction-type activities in the elementary grades which are closely correlated with regular school subjects. At the junior high school level (grades 7, 8, and 9), a broad exploratory base for students is provided for in the industrial arts curriculum. In the senior high school (grades 10, 11, and 12) the program gives greater depth of experience in one or more subject areas, such as, electricity and radio (electronics), graphic arts, and woodworking. This gradual increase in depth is reflected by advanced courses or by designating levels, such as, Level I, II, III, or IV to those school years in which the courses are offered.

Analysis of the main elements, which make up the guide, provide clues to areas of concern which industrial arts personnel direct their attention. These main elements, other than the instructional content, are: foreword, bibliography, administrative factors, list of tools and equipment, purpose and philosophy of industrial arts, general objectives, laboratory (shop) planning, safety, evaluation, methods of teaching, and public relations.

Caution must be used in interpreting the data because of the limitations of the study. For example, the study does not show the interrelationship of subject areas brought about by different methods used in teaching the instructional topics. Topics representative of all the subject areas can be integrated into a course in a comprehensive shop or laboratory. (See Figure 8.) Likewise, the teaching of electricity and radio (electronics) involves topics pertaining to metal and wood. Another method is to have a course representative of selected topics within a single subject area, but taught at greater depth.

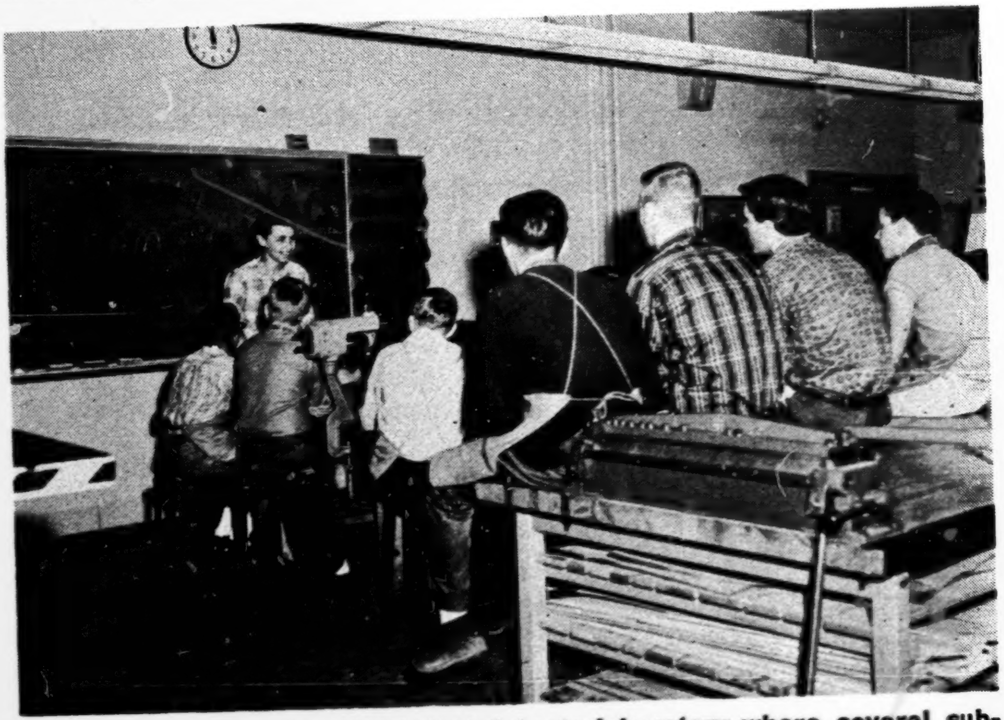

Figure 8.—A comprehensive industrial arts laboratory where several subject areas are integrated for a teaching plan. This student is reporting to the class about a hydroelectric dam.

The analysis does not provide the reader with the differences in depth of teaching topics which are similar at the junior and senior high school level. For instance, instruction concerning the topic *check* *lighting circuits* at the junior high school level could be an elementary-type circuit, whereas the same topic at the senior high school could be a complicated industrial circuit. The instructional content represented in the guides are usually suggestive—to be used as a guide for the teacher in the preparation of instruction and not necessarily complete or exhaustive.

Conclusions

This study identifies a range of instructional content or topics adjudged to be suitable for instruction in seven selected subject areas of industrial arts, and an emphasis given to these instructional topics as revealed by the frequency of mention by number of guides and by number of States reporting each topic. It also provides some clues as to the manner in which the content was presented in the guides with accompanying State organizational patterns, and identifies the main elements in the guides. On the basis of this study the following conclusions seem justifiable:

1. The instructional topics emphasized most for industrial arts were those dealing with: (*a*) project planning, (*b*) hand-tool techniques and machine processes, (*c*) technical information dealing with properties of materials and industrial processes, and (*d*) occupational information.

2. Less emphasis is placed on topics that relate to modern industrial developments and problems, such as, automation, jigs and fixtures, and other mass production devices, practices, consumer problems, new products, and processes (such as, semiconductors, atomic-electric plant), and human relationships.

3. Various methods are used to present the instructional content in the guides ranging from listing processes and study topics to a unit plan of instruction presented about a central theme. The State organizational patterns also vary, but reflect a broad exploratory experience for the student at the junior high school level and provide opportunities for greater depth of experience at the senior high school level.

4. The main elements contained in the State curriculum guides are the following:

   (a) Instructional content.
   (b) Foreword.
   (c) Bibliography.
   (d) Administrative factors.
   (e) Lists of tools and equipment.
   (f) Purpose and philosophy of industrial arts.
   (g) General objectives.

(h) Laboratory (shop) planning.
(i) Safety.
(j) Evaluation.
(k) Methods of teaching.
(l) Public relations.

Suggestions

If the industrial arts is that part of general education which purports to develop in the learner an intelligent understanding of the technical aspect of our society and to develop the technical talents possessed by individuals, then it should be concerned with the technical aspects of how man controls his physical environment to improve his well-being. It should deal directly with the processes of producing goods and with their personal and technological effects. It should use tools and machines to create form; to solve problems; and to synthesize concepts. Through direct experience of conceiving, designing, planning, arranging procedures, producing, and evaluating the results of the products, the learner can develop new insights in some of the important aspects of living.

As a result of these experiences, wholesome changes can take place in the learner which affect his habits, attitudes, and understandings. These changes may take the form of a developed interest in the man-made physical world—its materials and knowledge of how they are produced and fabricated; the place of the tool, the machine, and man in these processes; evaluating one's attitude toward constructive work; utilizing such work for health and recreation, as well as for its economic value; developing a favorable attitude toward creative thinking; character improvement—knowing and making the most of self and assuming self-expression and control over environment.

This self-exploratory or self-guidance function enables the learner to assess his latent abilities so as to determine a future course of action. This form of choice making, especially in the junior high school, is extremely important in deciding whether or not he will be a future scientist, artist, tradesman, technician, engineer, etc. He may be a thinker, an experimenter, an engineer where industrial arts with its tools, materials, and machines become the resources which enable him to solve technical problems: for the artist and others—a liberal element—that is, a person is not liberally educated, in the full sense of the word, unless he has acquired some technological understanding from his education; and for the tradesman and technician—fundamental technical information and skills about technology. The values derived from industrial arts experiences enable one to understand better his technological society and himself as a member within that society.

To bring about more fully these wholesome changes in behavior of the learner a redirection and reemphasis should be made in the industrial arts curriculum area. This does not mean that past experience is not usable, but rather the past must be used to build upon so that genuine improvement can be achieved in the future. For example, emphasis given to "project planning" as revealed by the analysis with topics, such as, *create a design, make a plan of procedure, calculate cost of material for a project, make a dimensional sketch* reflect efforts by the industrial arts teacher to bring about logical thinking on the part of students to solve technical problems. Through project planning, with the help of the teacher, the student *uses* other learnings, such as, mathematics and science in solving his technical problems in the industrial arts laboratory. The need for understanding these other disciplines becomes readily apparent to him if project planning is emphasized. Project planning or student planning in industrial arts should be continued and expanded. Likewise, topics dealing with "occupational information," such as, careers in lithographic printing and duplicating, in the field of plastics, and in manufacturing industries which employ draftsmen illustrate the significant guidance function that industrial arts offers to the students. As a result of discussions and activities related to various occupations (scientific, trade, engineering, etc.) and exploratory experiences, students are able to select their future lifework more intelligently. And, at the same time, learn to appreciate the contribution of other industrial occupations and professions to our technological society. Information related to occupations—trade, scientific, engineering, etc., should be continued and expanded.

It is possible that the industrial arts profession may wish to examine the topics closely with the expectation that some instructional content could be more effectively taught at the lower grade levels so that deeper understandings may be achieved at the junior and senior high school levels.

Instructional content as taught in the industrial arts laboratory should relate more directly to modern industrial developments and the basic problems of industry. It should be selected and presented in a way so as to bring about the desired behavior changes in the learner. This should be done at grade levels k–12 based on research findings and related to the characteristics of youth at their different levels of maturity.

Industrial arts can be more than teaching the hand and the machine processes and the related technical information needed to make a "project" in the traditional sense of the word. What the student does in the industrial arts laboratory ought to be related to the significant technological problems, such as, mass production, improvement of product design, research and development, new machines and processes, uses for new materials, labor utilization, management, automation, safety, and communication. These problems then can provide central themes to direct the students' efforts toward developing desirable attitudes and understandings of these problems.

Developing ability to solve technical problems will come about more readily if students are challenged to solve technical problems presented to them. Redesigning a jig or fixture to improve its efficiency is a real live problem in time and motion study with its related technical aspects. Redesigning or creating a new product is still another. Approaching teaching from this point of view gives greater meaning to the operations, processes, and technical information which must be learned to solve the problems. Therefore, a first step for industrial arts curriculum planners could be to identify these main problems of industry appropriate for study at the different grade levels. Second, select guidelines that aid in determining the most significant problems. Third, after a specific problem is identified, teaching units could be prepared to bring about a desired learning situation with the focal point of the unit directed to the problem.

It is entirely possible, in fact probable, that new courses may emerge around significant problems of industry rather than around traditional industry materials, such as, wood and metal. Evidence seems to point in this direction with course titles of transportation laboratory, graphic arts, and rudiments of technology. Others might be industrial research and development, principles of production, industrial technology, communications, new materials and new processes, etc.

An example of an outline for a teaching unit in which curriculum planners could organize the materials for teaching so that the instructional content bears more directly on significant industrial problems commensurate with the students' abilities and interests follows:

I. INDUSTRIAL OR TECHNOLOGICAL PROBLEMS:

Identification of the problem should be made with reference to major issues, principles, and values of our technological society that should be preserved and strengthened. The problems selected should be in keeping with the abilities and the interests of the pupils.

II. SPECIFIC OBJECTIVES:

Specific statements should be made clarifying the specific direction in which the problem will be attacked.

III. SUGGESTED APPROACHES:

More than one approach should be suggested. Student motivation ought to be taken into consideration.

IV. **Student activities:**

A list of several student activities should be prepared taking into account the varying abilities and interests of the students. Group and individual activities should be selected. "Project" guidelines should be established to determine the appropriateness of the student activities in accomplishing the problem. Student activities should not be limited to the traditional concept of the "project" but include experiments, group activity, etc.

V. **Class topics:**

The class topics, including demonstrations and experiments, etc., must be drawn directly from the problem and bear on the student activities. Application of scientific principles, applied mathematics, economics, and consumer data, etc., as well as the technical information and industrial processes would be appropriate topics provided they have a close relationship to the problem.

VI. **References:**

Included here would be appropriate teaching materials and aids of all types (i.e., books, periodicals, films, etc.).

VII. **Summary and evaluation:**

At the close of the unit *and* before the beginning of the next, a summary of the work completed and its relationship to the problem should be made. Student and teacher evaluation using standard techniques may be effectively used.

Pilot classes using this problem approach in selecting instructional content for teaching industrial arts could be established in selected schools to test this proposal. It is conceivable that individual teachers, or groups of teachers working together can effectively redirect their industrial arts program within their present laboratory facilities. After experience has been gained, the problems will no doubt, indicate that new materials, new equipment, new processes, and new information will be needed to solve or to understand the problem better. This approach should not be considered as *the way*, but as *one way* to bring about improvement in industrial arts education.

Finally, future writers of curriculum guides for industrial arts may wish to consider the following main elements as a part of a proposed State guide, or to consider some of them as separate publications. They are as follows: (1) purpose and philosophy of industrial arts, (2) general objectives of industrial arts, (3) instructional content based on a series of teaching units directed toward significant industrial problems, (4) administrative factors, (5) laboratory (shop) planning, (6) suggested lists of tools and equipment, (7) safety, (8) evaluation procedures and techniques, (9) methods of teaching, (10) public relations, and (11) general bibliography.

Bibliography

THE FOLLOWING 39 State curriculum guides were used in this study, representing current official instructional material for industrial arts from 1953 to 1958. State supervisors of industrial arts, consultants, or other persons working with the program in each State department of education have been responsible for the guides.

The annotations indicate the type of material covered in each guide.

To secure individual copies, it is suggested that contact be made directly with the State department concerned to ascertain their availability and cost.

ARKANSAS

Industrial Arts, General Shop. Bulletin of Arkansas State Department of Education. Little Rock: 1953. 145 p.

Contains statement of objectives; instructional units in woodwork, electricity, drawing, sheetmetal, printing, and machine shop. Content divided into activities (manipulative); and informational units. Suggests hand tools, equipment, supplies, and teaching aids. Annotated bibliography.

Industrial Arts, Home Mechanics. Bulletin of Arkansas State Department of Education. Little Rock: 1953. 34 p.

Contains instructional units of woodworking, electricity, plumbing and heating, masonry, painting, yard repairs, and automotives. Course has detailed activities (manipulative), and informational units. Suggests projects, equipment, and supplies for each unit.

CALIFORNIA

Suggested Courses of Instruction in Industrial Arts for the Junior High School Level. Bulletin of California State Department of Education. Sacramento: 1953. 48 p.

Contains course outline for junior high school exploratory and basic work in drawing, general wood, general metal, electricity, handicrafts, graphic arts, and comprehensive general shop. Outlines activities, skills, and processes; related technical information; and suggested project areas.

Suggested Courses of Instruction in Industrial Arts for the Senior High School Level. Bulletin of California State Department of Education. Sacramento: 1955. 71 p.

Contains course outline for intermediate and advanced work in automotives, drafting, electricity-radio (electronics), graphic arts, handicrafts, metal (general), photography, wood (general), and comprehensive. Organizes content under headings: activities, skills, and processes; related technical functional information; and suggested project areas.

GEORGIA

Industrial Arts for Georgia Schools (A Handbook for Teachers and School Administrators). State Department of Education. Atlanta: 1958. 111 p.

Characteristics of human growth; curriculum patterns; selection, preparation, and presentation of subject matter; administrative organization; records and forms; safety; evaluation; public relations; school shop planning (layouts). Has instructional units in mechanical drawing, woodworking, art metalwork, electrical work, general metalwork, sheetmetal work, machine shop, welding, and foundry. Outlines content under two headings: *know* and *do* topics. Bibliography.

HAWAII

Industrial Arts Guide. Department of Public Instruction. Honolulu: 1957. 161 p.

Includes objectives and behavior changes. Has detailed teaching guide for instruction units in drawing, woodworking, metalwork, and electricity. Outlines content under *know* and *do* units. Presents tests and teaching aids. Bibliography.

IDAHO

Industrial Arts Study Guide for Grades 7–12. Bulletin of Idaho State Department of Education. Boise: 1955. 97 p.

Contains definition of industrial arts, objectives, purposes, scope, and shop organization; floor plans and tool lists; instructional areas in woodworking, drawing, electricity, and metal. Outlines content under two headings: detailed *know* and *do* units. Bibliography.

Plastics, a Tentative Handbook for Teachers, Grades 7–12. State Department of Education. Boise: 1956. 60 p.

Comprises objectives, project suggestions, analysis form, and project chart. Incorporates 20 operation sheets, 6 assignment sheets, 4 information sheets, and 4 lesson plans. Bibliography.

ILLINOIS

Industrial Arts in Grades Seven and Eight. Series A-Bulletin No. 140; Illinois State Board for Vocational Education. Springfield: 1953. 104 p.

States need for industrial arts, philosophy, objectives, how to start a program, and safety. Suggests instructional areas in sketching and planning, woodcraft, metalcraft, leathercraft, keene cement craft, pottery (ceramics), plastics, block printing, jewelry, silk screen printing, bookbinding, photography, and and bicycle repair. Detailed *know* and *do* units. Suggests instructional materials and shop organization. Contains shop layouts, equipment, supply lists, and criteria for evaluating program. Bibliography.

KENTUCKY

Industrial Arts for Kentucky High Schools. State Department of Education. Frankfort: 1953. Educational Bulletin No. 4, Vol. XXI. p. 247–399.

Includes general objectives, organization and administrative planning and equipping school shops. Explains how to select, prepare, and present subject matter. Offers instruction units in mechanical drawing, woodworking, metalworking (machine shop, sheet metal, foundry, forge and heat-treating, welding), electrical work, automotive shop, and printing. Operational and information units. Suggests student activities for a comprehensive general shop and farm shop. Contains audio-visual aids. Bibliography.

MAINE

Curriculum Guide-Industrial Arts in Maine. Maine Association for Industrial Education. Gorham: Gorham State Teachers College, 1954. 56 p. (Official State Guide of State Department of Education, Augusta).

Suggests content for three levels of instruction—basic, intermediate, and advanced. Includes instructional areas in electricity, metalwork, transportation, and woodwork. Contents: suggested projects, problems, activities; operations and processes; and related information. States specific objectives for each area, and general objectives for industrial arts. Bibliography.

MINNESOTA

Teaching Guide for 7th and 8th Grade Plastics. State Department of Education. St. Paul: 1957. Code XXIII-B-73. 34 p.

Contains objectives, four instructional units for the seventh grade and six for the eighth grade. Operation and information units. Presents tips on tools and processes. Reports sources of supply and audio-visual aids. Bibliography.

Teaching Guide for 8th Grade Woodwork. State Department of Education. St. Paul: 1953. Code XXIII-B-68. 9 p.

A continuation of seventh grade woodwork; contains units about various woodworking machines. Suggests teaching approaches for units. Bibliography.

Teaching Guide for 8th and 9th Grade Electricity. State Department of Education. St. Paul: 1955. Code XXIII-B-71. 38 p.

Has instructional units in electricity for magnetism, flow of electricity, heat from electricity, light for electricity, power from electricity, and communications. Organizes content under activities, operations, displays, and information units. Contains sample test, bulletins, charts, posters, and films. Suggests teaching approach to units. Bibliography.

MISSOURI

A Guide for Industrial Arts—Grades 7–8. State Department of Education. Jefferson City: 1957. Publication No. 109–G. 87 p.

Has information on basic principles and problems to be considered in planning the junior high school curriculum; lists general growth characteristics of early adolescents which have implications for education; sets forth a point of view for industrial arts education; has suggested floor plans and equipment lists. Suggests teaching plan in drawing and planning and sketching, electricity, metalwork, woodwork, leather, plastics, and ceramics. Content is arranged in five columns: (1) areas of course, (2) suggested projects and sources of projects, (3) demonstrations, (4) topics for class discussion and special reports, and (5) other activities. Suggests several projects developed as job assignment sheets. References.

NEBRASKA

Industrial Arts for Nebraska Schools, An Instructional Guide. State Department of Public Instruction. Lincoln: 1954. 146 p.

Incorporates philosophy, objectives (characterized—by behavior changes), and safety. Contains instructional areas in drawing and planning, woodworking, metalworking, practical electricity, general crafts (ceramics, leatherwork, plastics, art metal, jewelry), home maintenance, and machine woodworking. Has information on audio-visual aids. Bibliography.

NEVADA

Industrial Arts in Nevada. State Board for Vocational Education, State Department of Education. Carson City: 1956. 43 p.

Explains general objectives, organization, and administration of the program. Has instructional units in drawing, woodworking, metalwork (sheet metal, art metal, molding), general crafts (metal tooling, plastics, leather), general electricity, and home mechanics. Organizes content under manipulative skills and related information. Suggests tools, equipment, and teaching aids. Bibliography.

NEW JERSEY

Industrial Arts Teacher Guide for Elementary Grades. Course of Study, Vocational Division, State Department of Education, Curriculum Laboratory. New Brunswick: 1958. 69 p.

General aims and objectives, administration, and safety instructions for grades 5 through 8; suggests instructional areas in wood, metal, leather, plastics, electricity, mechanical drawing, ceramics, and home mechanics. Outlines contents under: tools and equipment, materials and supplies, skills and processes, related information, and suggested projects. Cites additional information to assist teachers as more instructional areas are included for each grade level.

NEW YORK

Industrial Arts, Syllabus in General Electricity. The State Department of Education. Albany: 1956. 95 p.

Reports definition of industrial arts, objectives, records, and time allotment. Contains 18- and 36-week course outline. Gives instructional units in wire, signal systems, lighting systems, power systems, household appliances, heating devices, magnets, electrochemistry, motors and generators, control devices, radio and electronic devices, and measuring instruments. Projects, demonstrations, and related lessons (planning, social economics, guidance, science, safety and hygiene, and consumer values). Suggests outside preparation. Illustrates record forms. Bibliography.

Industrial Arts, Syllabus in General Printing. The State Department of Education. Albany: 1955. 87 p.

Contains definition of industrial arts, objectives, records, and time allotment. Has 18- and 36-week course outline. Comprises instructional units in letterpress printing, stockwork and bindery, silk screen printing, relief cuts for letterpress printing, offset lithographing, intaglio printing, papermaking, photography, and stenciling. Projects; operations and processes; demonstrations and related lessons (planning, social economics, guidance, science, safety and hygiene, and consumer values). Suggests outside preparation. Illustrates record forms. Bibliography (films, periodicals, manuals and charts).

Industrial Arts, Syllabus in General Woodwork. The State Department of Education. Albany: 1956. 93 p.

Incorporates definition of industrial arts, objectives, records, and time allotment. Contains 18- and 36-week course outline, instructional units in common hand and machine tools, boat building, carpentry and concrete form construction, furniture construction and upholstery, model aircraft, and pattern making. Projects, operations and processes, demonstrations and related lesson topics (planning, social economics, guidance, science, safety and hygiene, and consumer values). Suggests outside preparation. Illustrates record forms. Bibliography (tests, charts and posters, audio-visual aids).

NORTH DAKOTA

Industrial Arts Course of Study (High School). Bulletin of North Dakota State Department of Public Instruction. Bismarck: 1953. 160 p.

Contains statement of objectives for industrial arts. Has instructional areas in mechanical drawing and planning, woodworking, general metal, electricity and crafts (electricity, metal tooling, plastics, leather), home mechanics, motor mechanics, and welding. Outlines each unit under purpose, objectives, suggested activities, manipulative skills to master, related information, teaching aids and devices, references and sources of supply, tools and equipment, and evaluation. Has four shop layouts. Discusses administrative factors and instructional techniques. Lists free and low-cost teaching aids, books, periodicals, sources of supply, and films.

OHIO

Elementary Electricity, Suggested Outline for Developing an Industrial Arts Program. State Department of Education. Columbus: 1956. 16 p.

Provides an outline for an electrical unit. Suggests related topics, experiments, and manipulative problems. Discusses organization and administration. Lists equipment. Bibliography.

Graphic Arts: Suggested Outline for Developing a Graphic Arts Unit. State Department of Education. Columbus: 1958. 11 p.

Has introduction, purposes, objectives of industrial arts, and suggestions for developing the program. Instructional areas include letterpress printing, linoleum and/or block printing, silk screen printing, and bookbinding. Suggests tools, equipment, and references.

Sheet Metal. State Department of Education. Columbus. 1955. 12 p.

Objectives, organization and management, and 11 suggested projects. Content organization under two headings: related information, and things a student should learn to do. Suggests material and equipment. Bibliography.

Suggested Course Outline for General Woodwork. State Department of Education. Columbus. 1957. 4 p.

Has outline of work in beginning and advanced woodwork. Lists 13 teaching suggestions.

Suggested Course Outline for Mechanical Drawing. State Department of Education. Columbus: 1957. 2 p.

Outlines content in mechanical drawing for grades 9-11.

OKLAHOMA

A Suggested Course of Study for Industrial Drawing in Oklahoma High Schools. Bulletin of Oklahoma State Department of Education. Oklahoma City: 1954. 57 p.

Includes objectives, purposes of drawing, teaching methods, and grade placement. Has summary of a suggested course of study; outlines problems and learning units. Offers drawing checklists, hints, teaching aids, and useful projects. Shows drafting room layout, drawing stool, bench, and cabinet. Annotated bibliography.

PENNSYLVANIA

Automotive Area of Industrial Arts Instruction, Pennsylvania Public Schools. State Department of Public Instruction. Harrisburg: 1953. Bulletin 331–A. 41 p.

Includes aims and objectives, organization of instruction, teaching aids, equipment, and supplies. Outlines content under things to do and know. Has instructional units in power generation, power flow, and road control. Shows shop layout. Annotated bibliography.

Electricity as an Area of Industrial Arts Instruction in Pennsylvania Public Schools. State Department of Public Instruction. Harrisburg: 1954. Bulletin 331–C. 83 p.

Comprises objectives, organization of instruction, teaching aids, equipment, and supplies. Outlines content in four parts: (1) understanding electricity, (2) distributing electricity in the home, (3) electricity at work in the home, (4) electricity at work in industry. Shows shop layout. Annotated bibliography.

Planning as an Area of Industrial Arts Instruction in Pennsylvania Public Schools. State Department of Public Instruction. Harrisburg: 1953. Bulletin 331–H. 40 p.

Involves aims and objectives, organization of instruction, teaching aids, equipment, and supplies. Outlines content under things to do and know. Shows planning-area layouts. Annotated bibliography.

Plastics as an Area of Industrial Arts Instruction in Pennsylvania Public Schools. State Department of Public Instruction. Harrisburg: 1953. Bulletin 331–I. 53 p.

Contains aims and objectives, organization of instruction, teaching aids, equipment and supplies. Outlines content under things to do and know. Shows shop layout. Annotated bibliography.

Sheet Metal as an Area of Industrial Arts Instruction in Pennsylvania Public Schools State Department of Public Instruction. Harrisburg: 1953. Bulletin 331–J. 43 p.

Embodies aims and objectives, organization of instruction, teaching aids, equipment, and supplies. Outlines content under things to do and know. Suggests content for all grades, including senior high school. Shows shop layout. Annotated bibliography.

Woodworking as an Area of Industrial Arts Instruction in Pennsylvania Public Schools. State Department of Public Instruction. Harrisburg: 1953. Bulletin 331–L. 53 p.

Incorporates aims and objectives, organization of instructional material and devices, teaching aids, equipment, and supplies. Outlines content under things to do and know. Suggests content for all grades including senior high school. Shows three shop layouts. Annotated bibliography.

TEXAS

Industrial Arts in Texas Schools. Texas Education Agency. Austin: 1955. Bulletin 565. 91 p. (not now available).

Cites objectives with behavior changes expected of students. Suggests program at different levels for kindergarten and grades 1–6; exploratory industrial arts, grades 7–10; general industrial arts, grades 9–12; advanced industrial arts, grades 10–12; and adult education. Contains statements of learning activities at elementary level (level I). Has suggestions for industrial processes and related study topics for exploratory level (level II), and general industrial arts (level III). Contains instructional areas in crafts, drafting, woodworking, metalworking, mechanics, electricity, and graphic arts. Has descriptions of advanced industrial arts (level IV) courses. Discusses safety program, promising teaching procedures, and laboratory planning. Bibliography.

UTAH

Industrial Arts in Utah, Part Two—A Course of Study. State Department of Education. Salt Lake City: 1957. Third Edition. 411 p.

Includes instructional areas in general drawing, block printing, silk screen printing, photography, woodworking, general metals, ceramics, art leatherwork, jewelry, plastics, power mechanics, electricity and radio, home mechanics, and auto mechanics. Gives for each area the purpose, suitable problems and projects, fundamental operations, new tools and equipment used, information units, teaching aids, references, and suggested method of approach.

VIRGINIA

Course Outline for Electricity. State Department of Education. Richmond: 1958. Industrial Arts Bulletin No. 5. 77 p.

Has objectives and terminology and recommends subject areas for grades 8–12. Contains outline of operations and related information for beginning electricity (18 weeks); advanced electricity (18–54 weeks); practical home appliance servicing (supplement); electricity in communications (36 weeks); electrical drafting (supplement, 18 weeks); electric motors-operation and maintenance (supplement, 36 weeks). Each outline lists manipulative operations, related information, suggested references, and projects. Has instruction, organization, and planning suggestions. Bibliography.

Course Outline for Woodworking. State Department of Education. Richmond: 1957. Industrial Arts Bulletin No. 3. 70 p.

Includes general and specific objectives, procedures for acquiring objectives, characteristics of industrial arts at different grade levels, possible subject areas, and terminology. Outlines operations and related information for instructional areas in beginning woodworking, furniture design, furniture upholstering, and boatbuilding (model and full-size), discusses instructional organization and planning. Bibliography.

WYOMING

Industrial Arts. State Department of Education. Cheyenne: 1955. 31 p.

Involves objectives and instructional units for various grade levels. Suggests instructional units (18 weeks in length) for seventh grade in drawing and woodwork, for eighth grade in metalwork and general crafts, for ninth grade in general electricity and home mechanics. Lists tools, equipment, and supplies for each unit. References.